The Healthcare Medicine Institute presents

CPR #4

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Contents

CPR #4

Overview

This course packet was designed to help you remain knowledgeable regarding the steps and processes for helping someone experiencing sudden cardiac arrest (SCA), bleeding, opioid overdose, snake bites, tick bites, and marine bites and stings. In addition, we provide respiratory protection, chain of survival, and emotional well-being information.

The following is a summary from the National Institutes of Health (NIH) on the topic of CPR:

> When someone's blood flow or breathing stops, seconds count. Permanent brain damage or death can happen quickly. If you know how to perform cardiopulmonary resuscitation (CPR), you could save a life. CPR is an emergency procedure for a person whose heart has stopped or is no longer breathing. CPR can maintain circulation and breathing until emergency medical help arrives.
>
> Even if you haven't had training, you can do "hands-only" CPR for a teen or adult whose heart has stopped beating ("hands-only" CPR isn't recommended for children). "Hands-only" CPR uses chest compressions to keep blood circulating until emergency help arrives. If you've had training, you can use chest compressions, clear the airway, and do rescue breathing. Rescue breathing helps get oxygen to the lungs for a person who has stopped breathing. To keep your skills up, you should repeat the training every two years.

Bleeding

Controlling bleeding is a very important skill. When a person experiences a major injury that causes significant loss of blood, their body becomes unable to move oxygen to their organ systems. All body tissues require oxygen to function—especially the heart and brain. Without oxygen, these organs will stop functioning and the victim may not survive.

Smaller injuries, like small cuts or abrasions, can often be treated with pressure and a bandage. It is important to clean the wound as well as possible to lessen the chances of an infection. To do this, run clean, warm or room temperature, water over the wound for several minutes until you no longer see any dirt in and around the wound. Then, let the wound air dry before placing a clean bandage or dressing over it. If you have an antibacterial cream or topical product available, use a small amount to cover the wound just before putting the bandage in place. While antibacterial cream is not absolutely necessary, it does help keep the chances of infection lower and the wound will heal faster if there is no infection.

Severe Bleeding

Severe bleeding, or bleeding that begins to pool on the ground, is a life-threatening situation and must be treated immediately. First, as with all first-aid scenarios, make sure the scene is safe before approaching the victim. If, at any time, the scene no longer becomes a safe place for you or the victim, call 911 and wait for professional help.

Protecting yourself from bloodborne pathogens is also important in these situations. The use of disposable medical gloves, like the kind found in most first-aid kits, is highly encouraged. Eye protection, such as goggles or glasses, is also a good idea due to the risk of blood splashing into your eyes. Gloves and eye protection are types of personal protective equipment that should always be worn when there is the potential for you to be in contact with blood or other potentially infectious body material. Finally, make sure you or someone else activates the emergency response system (e.g., calling 911) as early as possible so that professional help can be sent to you.

Step 1: Safety

After you have ensured that the scene is safe and have put on appropriate personal protective equipment, the first initial step is to place direct pressure over the wound.

Direct Pressure

To do this, take your gloved hand and place it directly on top of the wound and push inward. It often takes significant and prolonged pressure to slow or stop a major bleed, so be prepared to hold this pressure for several minutes before removing your hand. You can also apply direct pressure by taking a dressing, such as a gauze pad, and using it to apply pressure to the wound instead of just your hand. When using a dressing, do not remove it if it becomes soaked in blood. Instead, take another dressing, add it on top of the original one, and continue holding pressure.

Additional Action

If the direct pressure does not slow or stop the bleeding, additional action is necessary. If the wound is on a limb, such as an arm or leg, you can use a tourniquet to stop the bleeding. In these situations, it is best to use a manufactured tourniquet. If your first aid kit does not include a tourniquet, it is a good idea to add one before you need it. If you do not have a manufactured tourniquet, it is generally recommended that you skip this step unless you have been properly trained in creating an improvised tourniquet.

To use a tourniquet, place it on the affected limb, about two to three inches above the wound. Tighten the tourniquet until the flow of blood from the wound stops. This often takes a significant amount of tightening- if in doubt, tighten some more. It is also important to understand that this is very uncomfortable for the victim but is life-saving. Keep tightening until the bleeding stops. Once the bleeding has been stopped, make sure you write down the time you applied the tourniquet.

Sometimes, after an injury, the blood vessels may shrink or recoil slightly. When this happens, the tourniquet may not completely squeeze the entire vessel. If you reach a point where you can no longer physically tighten the tourniquet but the wound is still bleeding, a second tourniquet can be useful

in squeezing the rest of the vessel. To do this, place the second tourniquet two to three inches above the first and repeat the process. Do not loosen or remove the first tourniquet. If you only have one tourniquet, skip this step and try other methods of controlling the bleeding.

Hemostatic dressings

For situations when a tourniquet is not working, or when you are not able to use a tourniquet like shoulder, hip, or abdominal injuries, begin with direct pressure. If you have a hemostatic dressing available, such as QuickClot® or Celox®, use it instead of a regular dressing to help you apply direct pressure to the wound. Hemostatic dressings have special chemicals embedded in them that react with blood to help form blood clots.

It is very important that you do not remove these dressings once put in place as they become part of any developing blood clots and removing them will likely remove the blood clots.

KNOWLEDGE CHECK

The best way to control severe bleeding on a limb not responding to direct pressure is:

A) Wash with water and put on a bandage
B) A manufactured tourniquet
C) Hemostatic dressings
D) Nothing will help

Answer: (B)

Opioid Overdose

Opioids are a class of narcotics that include illegal drugs such as heroin as well as some legal drugs such as oxycodone and hydrocodone. These narcotics, while very effective at pain control, are also very addictive.

Both intentional and unintentional overdoses are both common and potentially fatal. A side effect of opioids is respiratory depression, which can be seen as a slowing breathing rate and shallow breaths. This can cause a victim to become hypoxic, a situation in which a person no longer has enough oxygen in their body to live, and can cause death if left untreated.

For years, hospitals and emergency services have been able to administer a drug called naloxone to victims of an opiate overdose. Naloxone works by attaching to the same receptors in the body that opiates attach to. This stops the body from responding to the opiate and both reverses and prevents the respiratory depression. Due to recent legislation, naloxone is now available in most pharmacies and, in many cases, available over-the-counter without a prescription. If you or someone you know is struggling with an opiate addiction, having naloxone nearby may be a life-saving decision if an overdose occurs.

A victim of an opioid overdose will generally be unconscious. It is common to see signs of hypoxia such as a very slow breathing rate (zero to six breaths a minute), and a bluish color of the lips and fingernail beds. This blue coloring is called cyanosis. Look quickly for open or empty medication bottles nearby. In cases of a heroin overdose, it is also common to see drug paraphernalia around the victim such as used syringes and marks on the hands and arms from frequent self-injections.

If you suspect that a victim is experiencing an opioid overdose, immediately call 911 and ensure the area is safe. If you do not suspect a neck injury such as from a fall or other trauma, roll the victim onto his or her side to help keep the airway open. Do not place your finger

into the victim's mouth to attempt to remove foreign matter. If you do not have access to naloxone, stay with the victim until help arrives. If the victim is not breathing at all and does not show any signs of life such as muscle or chest movement, begin the steps of CPR.

Naloxone that is available to the general public is often available as either an autoinjector (similar to an EpiPen in design) or by an intranasal spray. To use the autoinjector, remove the protective cap from the end of the device. Do not place your fingers near this end of the device once the cap is removed. Some autoinjectors do not have a protective cap on the needle end, but instead have a removable end-cap on the opposite end that arms the autoinjector. Put the needle side of the device against a large muscle such as the thigh and push into the muscle until you hear a click. This click is the needle shooting out of the device and into the muscle. It is not necessary to remove clothing to use this device as the needle is designed to penetrate most normal clothing. Hold the device in place for at least 10 seconds to ensure all of the medication is delivered before removing the device. Place the used device in a safe container to protect you and others from accidentally touching the used needle.

Intranasal spray devices look like a syringe with a plunger at one end and a cone at the other. Insert the tip of the cone into one of the victim's nostrils and, using the plunger, quickly squirt about half of the syringe into the nose. Remove the device and do the same with the other nostril, using the remainder of the naloxone. Make sure the cone is inserted into the nostril as far as it will easily go. You do not need to apply significant pressure but you do want the nostril to create a seal around the cone to keep the naloxone in the nose as you administer the naloxone.

After administering naloxone, stay with the victim until help arrives. It is not uncommon for a victim to wake up quickly after you administer the naloxone. While this is a good sign, some forms of opiates stay in the body longer than naloxone so the victim may become unconscious again after the naloxone wears off. It is important that any victim of an opiate overdose be taken to a hospital for further evaluation.

KNOWLEDGE CHECK

The medication, often found in an auto-injector pen or nasal spray, that can reverse the effects of an opiate overdose is:

A) Naloxone
B) Benadryl
C) Epinephrine
D) Heroin

Answer: (A)

KNOWLEDGE CHECK

If the victim of a suspected opiate overdose is not breathing and shows no signs of life, you should begin CPR.

A) True
B) False

Answer: (A)

Chain of Survival

The chain of survival is a series of events that, when practiced together, greatly increase the chance of survival for out of hospital cardiac arrest. These steps are portrayed as a chain, as the steps link together, and rely on each other for the best possible outcome.

Link 1

The first link in the adult chain of survival is to activate the emergency response system. In most cases, this means calling 911 (in the USA, other numbers may apply in other countries). This should be done as soon you realize that the victim is in need of medical attention. Be sure to provide the dispatcher with clear directions on where you are located. Depending on your location, such as in a large office building or in a large recreational area, it may be prudent to send another bystander to meet responders and guide them to you. If you are by yourself, consider using the speakerphone function on your phone so that you can talk with the dispatcher while moving to other steps in the chain of survival. Also, do not assume that by taking time to answer the questions of the dispatcher that you are delaying the dispatch of emergency personnel. In most cases, crews are being send to you by another dispatcher at the same time and all of the information you provide is relayed to these responders while they are en-route so that they are best prepared to help you as soon as they arrive.

Link 2

The second link in the adult chain of survival is high-quality CPR. When possible, it is best to activate the emergency response system and begin high-quality CPR at the same time by using multiple bystanders. **Remember that high-quality CPR requires fast and deep compressions, at least two inches at a rate of at least 100 compressions per minute.** If you are trained in providing breaths either by using a pocket mask or bag-valve mask, doing so is best.

However, if you are not trained or lack the proper equipment to do so safely, perform just compressions without stopping until help arrives. When able, it is also best to rotate the rescuer providing compressions every two minutes to avoid fatigue and ineffective compressions.

Link 3

The third link in the adult chain of survival is defibrillation. The use of an automated external defibrillator (AED) greatly increases the chances of survival. An AED should be used as soon as it is available. If you know there is an AED nearby, go get it. If there is another bystander nearby, send them to get it while you begin CPR. Many communities today utilize public access defibrillation programs, which often interface with smartphone apps such as *PulsePoint AED*. These resources can help you locate the closest AED and also alert other trained rescuers nearby so that they can provide help as well.

Link 4

The fourth link in the adult chain of survival is advanced resuscitation. This is generally provided by emergency services personnel once they arrive and includes advanced airway management along with certain emergency medications. While this link does not generally include bystanders, this link is impossible if you haven't completed the first link by activating the emergency response system. Remember that it can take 5–10 minutes, and in some cases even more, for emergency responders to reach you, so early activation is extremely important.

Link 5

The fifth link in the adult chain of survival is post-cardiac arrest care. Once a victim has been successfully resuscitated, recent studies have provided several steps of care that can lessen the chance that the victim goes back into cardiac arrest while increasing the chances that the victim can be discharged from the hospital without life-long deficits

caused by a prolonged lack of oxygen. These steps are typically started in an ambulance and continue at the hospital, sometimes for as long as several days following the event.

Recovery Link

The final step in the adult chain of survival is recovery. This final phase encompasses a series of plans developed by a doctor to address the cause of the cardiac arrest, prevention of future arrest events, and rehabilitation care. This phase also includes any needed psychological support for both the patient and the patient's family.

Pediatric Chain of Survival

There are two changes in the pediatric chain of survival for dealing with patients under eight years old. A new first link, prevention, is added to the front of the chain. This link focuses on preventing likely causes of pediatric arrest such as proper child restraint devices and environmental protections to prevent choking. The other change is the removal of the early defibrillation link. While defibrillation is still part of CPR for pediatric patients, it is far less important than with adults. Remember that, for adults, the use of an AED is done as soon as possible. For pediatric patients, the focus is on completing two minutes of quality CPR before considering the use of an AED.

Survival Chances

While the chain of survival contains several steps that the standard bystander won't participate in, it is very important to realize the importance the first few steps are in the ultimate care of a victim of cardiac arrest. Without bystander involvement both by activating the emergency response system and beginning high-quality CPR, the chain becomes significantly weaker and the chances of survival for the victim are drastically reduced.

KNOWLEDGE CHECK

The first step in the adult chain of survival is:

A) Post cardiac-arrest care
B) Prevention
C) AED
D) Activate the emergency response system

Answer: (D)

KNOWLEDGE CHECK

The first step in the pediatric chain of survival is:

A) Post cardiac-arrest care
B) Prevention
C) AED
D) Activate the emergency response system

Answer: (B)

Respiratory Protection

Most first-aid literature contains information on appropriate personal protective equipment (PPE), such as gloves and eye protection. This information is important to protect a person providing first aid from bloodborne pathogens. Today, there are additional concerns such as potential exposure to COVID-19 and other airborne contagions.

First, it is important to understand the difference between a bloodborne pathogen and a respiratory pathogen. In standard first-aid, we focus on the potential for exposure to pathogens spread by exposure to infected blood or other potentially infections body material (OPEM) such a Hepatitis or HIV. These pathogens are transmitted by direct exposure to infected OPEM. Further, an exposure requires that the pathogen actually enter your body. This requires, for example, that the infected blood or OPEM come in direct contact with broken skin on your hand, or with mucous membranes such as your eyes or mouth. As long as you wear appropriate PPE when providing care to a patient, it is highly unlikely that you will become infected with these types of pathogens.

Respiratory viruses present different challenges in providing first aid. Unlike blood or OPEM, which you can actually see, respiratory viruses are microscopic and are contained in similarly small droplets floating through the air. To become infected, you must inhale these tiny, virus-containing droplets. Unfortunately, because you cannot see these to avoid them, and because these droplets can travel several feet from the host, infection is much easier than with bloodborne pathogens.

The first level of protection often discussed is social distancing. The purpose of maintaining a distance of at least six feet is that the most current literature suggests that the small respiratory droplets can travel roughly six feet before they slowly drift towards the ground. While distance alone does not provide significant protection, it does significantly lessen the chance for a rescuer to inhale these pathogens and, when coupled with good hand hygiene techniques, provides a valuable barrier.

There are several available products to help reduce the chances of exposure to respiratory viruses such as COVID-19. Most have become familiar with surgical masks or other face coverings used commonly during the height of the pandemic. Most are also familiar with the controversy surrounding the effectiveness of these masks. These types of masks are not designed to protect the wearer from others. Rather, these masks are designed to protect others from the wearer. Their purpose is to place a barrier between the person wearing it and others to lessen or eliminate the distance the tiny respiratory droplets can travel. This is best illustrated by taking a spray bottle and observing the different in distance the spray travels when sprayed from behind a surgical mask and when sprayed with no mask.

Another common mask is the N95 respirator mask. There are several variations of this type of mask with perhaps the 3M oval-shaped mask and the standard “particulate respirator” often found at your local hardware store being the most recognized. Used correctly, these masks provide superior protection to the user by filtering out 95% of particles in the surrounding air and is the mask most healthcare providers use when treating a patient with a respiratory virus such as COVID-19.

There are several concerns with regards to common use of N95 masks. First, because these masks are designed to provide an effective seal against the user’s face, it is important to use a mask of the correct size. While standard workplace respirators may be labeled as “universal fit,” in healthcare; there is no such thing as a universal fit mask. In fact, healthcare providers are required to perform a “fit-test” on a regular basis in which the user wears the mask and is subjected to several aerosol sprays while performing specific tasks designed to test the seal such as talking, bending and moving. This is performed until the user can complete all of the tests without detecting the aerosol sprays. It is also important that the user be clean shaven to ensure a good seal.

Another concern with the N95 is the general health of the user. For healthcare providers, OSHA requires that the user be evaluated by a physician before wearing such a respirator. This is because the mask

increases the force required to breathe properly and may cause significant health problems for those with existing respiratory diseases such as asthma or COPD.

A complete understanding of these types of masks is important to make an informed decision about the potential risk of providing care to a victim potentially infected with a respiratory virus such as COVID-19. The most complete scenario that offers the best protection is for the victim to be wearing a surgical mask, the rescuer to be wearing a properly sized and tested N95, and to maintain a distance of at least six feet. This complete scenario is not always possible. Each rescuer will need to assess the risk and take the most appropriate and available steps using this information to lessen the chances of exposure when deciding how to best treat a victim requiring first aid.

KNOWLEDGE CHECK
A concern in using the N-95 mask is: A) They don't protect the wearer B) They allow 95% of particles to pass through the mask C) They have to be properly fit-tested regularly D) They do not protect against airborne viruses Answer: (C)

Emotional Well-Being

Choosing to become involved in an emergency is a very honorable decision. Not everybody is able or willing to provide care to victims that they do not know. It can be a very exciting and adrenaline-filled situation and fill you with overwhelming pride when you act and save a person's life.

After an event, it is not uncommon for rescuers to doubt or question some of their decisions. Sometimes this occurs because the outcome was not as positive as you had hoped. Other times, it is because you realize you forgot a step or performed something out of order. These are perfectly natural feelings and can be a source of motivation to learn or practice more, but can also be a source of self-doubt or even depression.

First, it is important to realize that you chose to become involved in a situation when others did not. Regardless of the outcome, that is something to be extremely proud of. Second, it is equally important to address your feelings to work through them in a positive way. Do not be afraid to talk to someone. Reach out to your local fire department of EMS agency for resources. A mentor, therapist, or even a good friend may provide help. Be honest with them, and yourself, to best work through these feelings.

Ultimately, remember that you did your best in a difficult situation.

Animal Bites and Stings

Bites or stings can often be uncomfortable. The good news is they are rarely life threatening. Just like with other emergencies, the first step in handling these types of situations is to make sure the scene is safe. This entails ensuring that whatever animal bit or stung the victim isn't close enough to bite or sting again. If you are unsure, move the victim to a different area where you know it is safe before starting to provide treatment.

Bee stings

There are several types of stinging insects you may encounter: wasps, bees, and hornets just to name a few. Most of these insects sting you when they feel threatened by you by injecting a small amount of venom into your skin through a needle-like stinger attached to their bodies. Some are even able to sting you multiple times. While painful, these stings are rarely life-threatening. Once you are sure you are no longer at risk for more painful encounters, apply a cold compress or ice pack to the painful area. The area may swell slightly, but the pain and swelling will quickly disappear.

Bees can only sting once and their stinger stays in the victim. If you see a small item similar to a splinter where you were stung, you were likely stung by a bee. While also rarely life-threatening, you need to remove the stinger before applying the cold compress. Use a thin, stiff object such as a credit card and scrape the skin over the site of the stinger. The card will catch the stinger and remove it. Do not attempt to pinch it with your fingers or tweezers. There is often a small, venom-filled sack at the top. Squeezing it will inject more venom into the victim. Once the stinger is removed, use a cold compress or ice pack over the area to help reduce the swelling.

Severe Reactions to Stings

Less common but noteworthy are acute systemic allergic reactions

that may result in cardiorespiratory arrest, acute toxic reactions to venom, and delayed reactions (e.g., encephalitis, neuritis, kidney and blood vessel inflammation, blood clotting disorders) that may occur days are even weeks after a sting. For severe acute reactions, activate the emergency response system (call 911). If the victim was prescribed an emergency epinephrine autoinjector (e.g., EpiPen, Auvi-Q), use it as directed by the physician.

KNOWLEDGE CHECK

When treating a bee sting, you should use tweezers to remove the stinger:

A) True
B) False

Answer: (B)

Severe Reactions & Anaphylaxis

While most people have a simple local reaction to a bee sting such as pain, itching, and some swelling around the site of the actual sting, some people can develop more severe reactions. These types of allergic reactions can cause swelling in other parts of the body, a rash known as hives, difficulty breathing and, in some rare cases, even death. It is important to carefully watch someone who has been stung to be sure they do not develop these more serious reactions.

The most severe of these reactions is known as anaphylaxis and can occur from bee stings, eating certain foods and taking certain medications. This life-threatening reaction causes the victim's airway to swell. If not treated, it can lead to death. **If the victim begins to complain of a scratchy throat, shortness of breath, or begins to show signs of swelling around the mouth and face, call 911 immediately as symptoms can progress very quickly.**

Life-saving Medication

Most people at risk for anaphylaxis have been told by their doctor about this condition and often carry life-saving medication that will help stop the reaction. An EpiPen is a pre-loaded syringe with a spring-activated needle. If your victim is showing signs of anaphylaxis, ask them if they have an EpiPen (or similar product).

If so, you can help them use it by removing the safety cap and pushing the end against their thigh until you hear a loud "click". Hold the pen in place for 5-10 seconds while the medication is administered, then safely remove and dispose of the pen, being careful not to touch the exposed needle. While this medication can be life-saving, it does not last very long. It is very important, if you have not already done so, to call emergency services so the victim can be taken to the hospital for further evaluation and treatment.

KNOWLEDGE CHECK
When providing care to a victim of a bee sting, it is important to: A) Observe for signs of a severe reaction B) Capture the bee for identification C) Apply a torniquet D) Immediately call 911 regardless of how the victim is responding Anwer: (A)

Snake Bites

Snake bites, while rare, can be a very frightening experience. The first step in providing care to someone bitten by a snake is to ensure the scene is safe. Quickly remove the victim from the area to ensure there are no further bites to the victim or you. Next, try to determine whether the bite was from a venomous or nonvenomous snake. Generally, venomous bites appear to have two puncture wounds where the fangs were inserted while nonvenomous bites appear more horseshoe-shaped with one or more small punctures. You may also be able to identify the snake itself, but do not attempt to capture it or put yourself at risk to do so.

Victims of a venomous snake bite need immediate care. Begin by activating the emergency response system as quickly as possible. Next, have the victim lie down in a safe place away from the snake. Remove any restrictive clothing and jewelry such as watches, rings and bracelets. If the victim was bitten in the foot, remove his or her shoes as well. Cover the puncture wounds with a loose dressing to

prevent infection. You should never apply a tourniquet to a bitten extremity, apply ice, or attempt to cut the wound. A tourniquet restricts blood flow, which allows the venom to stay concentrated, thereby destroying cells more aggressively.

Nonvenomous snake bites should be cleaned well and wrapped with a dry, clean dressing. While a victim of a nonvenomous bite may not present a critical situation, it is important to watch for any signs of infection and to seek medication attention if an infection begins to appear.

KNOWLEDGE CHECK
When treating a victim of a snake bite, NEVER: A) Lie the patient down B) Remove jewelry C) Apply a tourniquet D) Ensure the area is safe to provide care Answer: (C)

Tick Bites

Ticks are small bugs often found in wooded or overgrown areas. Their bites may be harmless and, often, aren't even felt by the victim. They can, however; carry diseases such as lyme disease, which can be harmful or even fatal to their victims. Lyme disease is caused by the bacterium Borrelia burgdorferi or Borrelia mayonii. Symptoms include fever, chills, neck stiffness, swollen glands, headache, fatigue, and skin rash (erythema migrans).

The most common appearance erythema migrans is a round/oval rash that expands to greater than 2 inches in diameter. If the inside of the lesion clears, this produces the appearance of what is referred to as a bull's-eye rash. It is clear in the middle with a red ring around it.

If you find a tick on your skin after being outdoors, the best way to prevent these issues is to quickly remove it. To do this, use a pair of tweezers and grab the tick as close to the area where the mouth is attached to the skin as possible. Gently lift the tick away from the skin until it detaches. Check the area of any remaining parts of the tick's mouth, then wash the area well. The tick should be placed in a sealed container and laboratory testing may be able to determine the presence of bacterium. Follow-up care with a physician, including antibiotic medications, may be necessary.

KNOWLEDGE CHECK
After removing a tick, you should follow up with your doctor. A) True B) False Answer: (A)

Marine Bites and Stings

Bites and stings in the marine environment are often uncomfortable but they are rarely life-threatening. For bites, the area should be washed well with soap and water to prevent the wound from getting infected. Then, wrap it with a clean, dry dressing. For severe bites with significant blood loss, follow the same steps in the bleeding control section.

To treat stings, first remove whatever is causing the sting such as a jellyfish tentacle. Be careful when completing this step so that you do not cause another sting on your hand. Wash the area well to remove any remaining parts of the tentacle. A topical anti-itch cream can also be applied if the skin is not broken to help reduce the discomfort. If the skin is broken, wrap it in a clean, dry dressing to prevent an infection.

The sting from some animals is more potent than others. It is a good idea to be familiar with the animals common in the area you are swimming. If you experience more severe symptoms such as extreme pain, muscle tremors, or difficulty breathing, seek medical attention immediately.

KNOWLEDGE CHECK
When providing care to a victim of a marine sting, you should: A) Wash the area well B) Capture the animal for identification C) Apply a tourniquet D) Cut open the wound Answer: (A)

Sudden Cardiac Arrest

Before we can begin consider how to care for a person in cardiac arrest, let's first review the definition of sudden cardiac arrest.

Like every muscle in your body, the heart muscle moves when stimulated by an electrical impulse. The heart, however, does not rely on your brain to send these impulses like all other muscles; it creates its own electrical current from nodes located inside the heart. The sinoatrial node, located in the upper right portion of the heart, is primarily responsible for creating this impulse that then travels through conduction pathways through the muscle in an organized manner. As this impulse travels it stimulates the different areas of the heart to contract, pumping blood through the body. When these impulses become disorganized or do not not pass through the muscle in the correct manner, called an arrhythmia, the heart muscle can have trouble pumping effectively.

The most common cause of SCA is an arrhythmia called ventricular fibrillation (VF). In VF, the impulses become erratic and causing the heart muscle to quiver instead of pump, stopping the flow of oxygen and nutrients through the body. This arrhythmia can be caused by an electric shock, drugs, or trauma.

According to the NIH, the following is the definition of ventricular fibrillation:

> **Ventricular Fibrillation**
> V-fib occurs if disorganized electrical signals make the ventricles quiver instead of pump normally. Without the ventricles pumping blood to the body, sudden cardiac arrest and death can occur within a few minutes.
> To prevent death, the condition must be treated right away with an electric shock to the heart called defibrillation.
>
> V-fib may occur during or after a heart attack or in someone whose heart is already weak because of another condition. [1]

A myocardial infarction (i.e., a heart attack) occurs when the arteries that feed the heart with oxygen become blocked, which can also cause SCA.

1 nhlbi.nih.gov/health/health-topics/topics/arr/types

According to the NIH, the following is the definition of a heart attack:

What Is a Heart Attack?

A heart attack happens when the flow of oxygen-rich blood to a section of heart muscle suddenly becomes blocked and the heart can't get oxygen. If blood flow isn't restored quickly, the section of heart muscle begins to die.

Heart attack treatment works best when it's given right after symptoms occur. If you think you or someone else is having a heart attack, even if you're not sure, call 9–1–1 right away. [2]

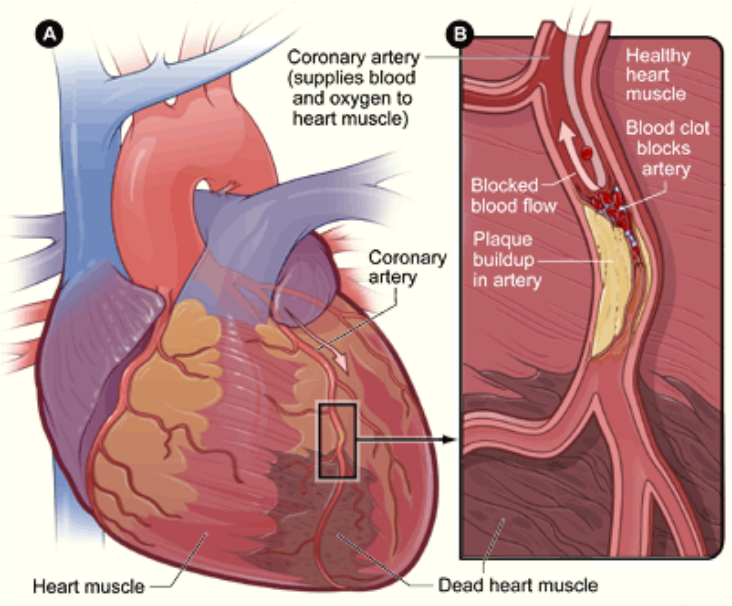


Figure A is an overview of a heart and coronary artery showing damage (dead heart muscle) caused by a heart attack. Figure B is a cross-section of the coronary artery with plaque buildup and a blood clot. (credit: NIH – National Heat, Lung, and Blood Institute)

It is important to note that vital organs begin suffering immediate damage during SCA. The goal for treating SCA is to correct the arrhythmia to regain

2 nhlbi.nih.gov/health/health-topics/topics/heartattack/

blood flow throughout the body before these organs suffer irreversible damage. Studies have shown that immediate bystander cardiopulmonary resuscitation (CPR) and the use of an automated external defibrillator (AED) offer the best chance of survival for the patient.

Know when to help

Recognizing a person is suffering from sudden cardiac arrest is an important step in beginning appropriate treatment. If sudden cardiac arrest is suspected, it is important to complete a quick assessment to determine if the patient requires CPR or other advanced care.

Assessing the patient

A patient suffering from SCA will appear unconscious and unresponsive. This does not mean that someone who is awake is not suffering from another medical emergency. If you suspect that a person is experiencing a medical emergency for any reason, call for help. In the USA, calling 911 activates the emergency response system. Stay with them until medical help arrives if possible.

Check for Safety

The most important first step in any emergency is to make sure the area is safe. Do not put yourself in a dangerous situation, which could result in you also being a patient. Check the area for dangers such as electrical shock, violence, or traffic. If possible, move the patient to a safe location before providing any care. If you are unable to move the patient to safety, immediately leave and call for help.

Check for Responsiveness

Once you are sure you are in a safe environment, attempt to wake the patient. **Shake or tap the patient and shout, “Are you ok?”**

- If the patient responds, try to determine if additional help is needed. If you have any doubt as to whether or not the patient requires further assistance, call 911 for help.

- If the patient does not respond, get help. If bystanders are available, send one to call 911 for help and to look for an automated external defibrillator (AED). If no bystanders are available, immediately leave the patient and call 911 (or use a cell phone) and attempt to find an AED. Return to the patient as soon as possible.

Image 2: Check the patient for signs of life such as chest rise or other movement. *Credit: Virginia State Parks CC / BY*

Check for Signs of Life

After you or a bystander has activated the emergency response system by calling 911, return to the patent. Take at least 5 seconds, but no more than 10, to closely watch the patient for any signs of life (image 2). Look for chest rise (indicating breathing), listen for grunting, groaning, or sounds of heavy breathing, or place your hand on the patient's chest to feel for rise and fall. If any of these signs of life are present, the patient is not experiencing SCA but may be experiencing a life-threatening medical emergency. Stay with the patient until help arrives and continue to check for these signs of life. Note, gasping is not a sign of normal breathing.

Some advanced-level providers are trained to check the patient for a pulse and more thoroughly check the patient's airway and breathing. These steps are not wrong but can be difficult to perform and are time consuming if not practiced regularly. It is also possible for untrained rescuers to misinterpret these signs, causing them to inappropriately withhold CPR. It is therefore not recommended that lay-rescuers perform these steps.

If no signs of life are present, the patient is most likely in cardiac arrest and immediate action is required.

Calling for Help

It is important to call for help as soon as you suspect that the patient is requires help. While a patient in cardiac arrest needs CPR, most cases of SCA cannot be solved by CPR alone. CPR is also a physically-demanding activity and rescuers will quickly tire when correctly performing chest compressions. Once you activate the emergency response system, help is on the way. It is also possible to begin further care while calling for help, if mobile phones are available.

Self-Knowledge Check

What is the most important first step in helping in any emergency?

(Answer located at the bottom right corner of this exercise box.)

A) Check for Safety
B) Immediately call 911
C) Check a pulse
D) Check for signs of life

Answer: A

Know how to help

Compressions

Once you have identified that an adult is in SCA and requires CPR (and the emergency response system has been activated), the next step is chest compressions. In review, identification of SCA involved two major steps:

1. *Check for Responsiveness*
   Attempt to wake the patient: Shake or tap the patient and shout, “Are you ok?”

2. *Check for Signs of Life*
   Look for chest rise (indicating breathing), listen for grunting, groaning, or sounds of heavy breathing, or place your hand on the patient’s chest to feel for rise and fall. Advanced provider: check for pulse, airway, and breathing issues.

Chest compressions squeeze the heart, building up pressure within the heart’s chambers to begin pumping blood. Good compressions circulate oxygenated blood throughout the body, slowing the damage to the heart and other organs caused when these organs have stopped receiving blood from the heart. **It is important to provide good, quality chest compressions during CPR** to maximize blood flow and increase the chances of survival. Let’s look how to perform chest compressions for adults. According the the NIH, adults are defined as 9 years and older for purposes of CPR distinctions.[3] Later, we will go over how to provide help for children and infants.

Next is a photo example of chest compressions. Later, we will show many alternate and close-up views of this same procedure to better illuminate the techniques involved.

3 medlineplus.gov/ency/article/000013.htm

Image 3: Position your body directly over the patient, locking your elbows to provide chest compressions. *Credit: Betsy Weber CC / BY*

Expose the Chest

First, quickly expose the adult patient's chest. This allows rescuers to ensure proper hand placement and prepares the patient for use of the AED without having to stop compressions when one becomes available. If the patient is not on their back, carefully place the SCA victim on their back. In some cases, their may be the possibility of a spinal injury. If another person is available to help, the two of you can turn the patient onto the back without twisting the head or neck. This helps to prevent further complications relating to spinal injuries.

Compression Technique

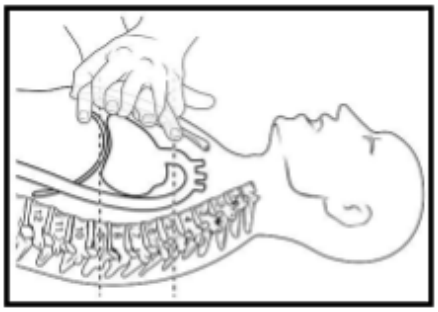


Image 4: Proper hand placement during CPR compresses the heart forcing blood flow. *Credit: OpenStax College CC / BY*

- To perform compressions, position yourself at the patient's side.
- Place the heel of one hand on the sternum in the center of the chest between the nipple line.
- Place your other hand on top of the other, interlocking your fingers. Slightly pull your fingers back so that only the heel of your hand is on the patient's chest.
- Lean over the patient so that your shoulders are directly over your hands and lock your elbows (image 3).
- Begin by pushing straight down onto the chest hard and fast. Press down approximately at least two inches (5 cm).
- Lift up, bringing your weight completely off the chest but keeping the hands in place. Let the chest completely rise.
- **Continue to do this at a rate of 100 per minute.**

It is important to ensure that your compressions are hard and fast. With each compression you are building pressure inside the chest to help push blood to vital organs (image 4). Compressions that are too shallow or too slow do not build the necessary pressure and will not improve the chance of survival. It is also important to release the pressure on the chest so that the heart can refill with blood before your next compression. In review:

- The hard and fast compression move the chest downward approximately 2 inches to push blood to vital organs.
- The release of pressure refills the heart with blood and is accomplished by letting the chest completely rise.

Some rescuers have been trained to provide ventilations to a patient after 30 compressions. If you have not received hands-on training to do this, do not stop compressions. Continue providing compressions, at least two inches deep, at a rate of at least 100 per minute or until help arrives or until you can no longer physically continue.

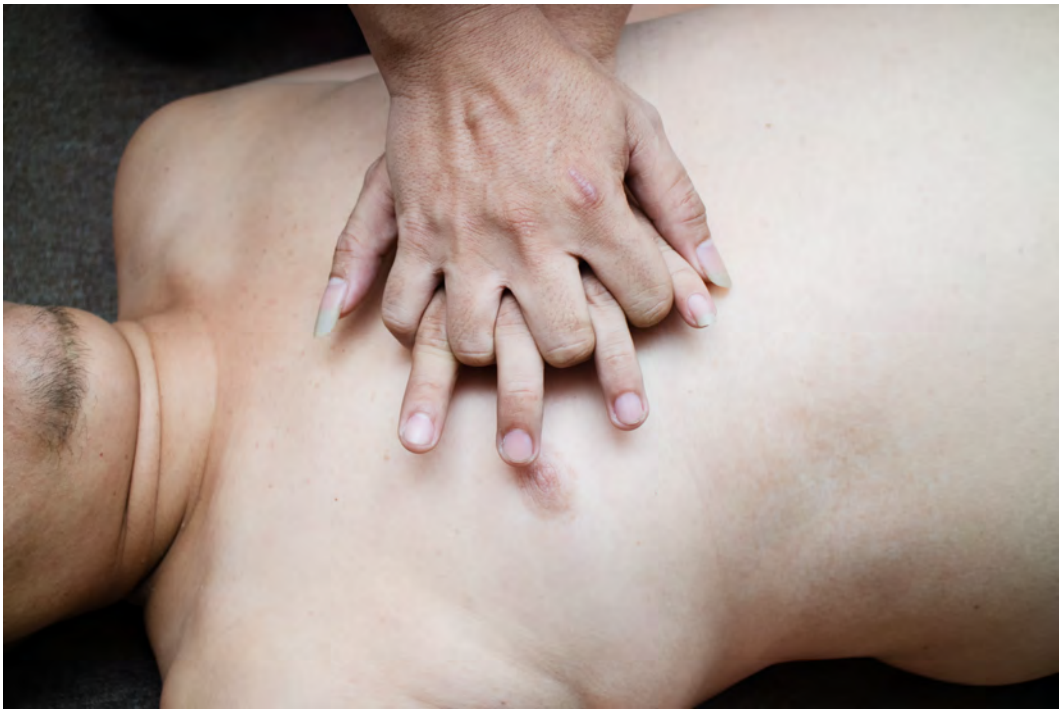
Compressions can be very physically demanding. If other help is available, try switching rescuers every two minutes until advanced care arrives. This ensures that compressions remain effective and improve the chance of

survival. Remember, if there is movement, breathing, coughing, do not apply chest compressions.

Chest Compressions

Chest Compressions

Chest Compressions



Chest Compressions

Chest Compressions

Ventilations

CPR is most effective when the rescuer can increase the level of oxygen available in the blood by providing ventilations. This can be accomplished by advanced methods such as endotracheal intubation, a bag-valve mask with supplemental oxygen, or even the use of a pocket mask or other barrier device during mouth-to-mouth. While these methods do provide some benefit during CPR, they can be difficult to perform properly. **If you are uncomfortable providing ventilation to a patient, skip this step and provide compression-only CPR.** Sometimes, compression-only CPR is termed hands-only CPR.

30 Compressions, 2 Breaths

When providing ventilations, first perform 30 quality chest compressions. Then, perform a head-tilt chin-lift by placing two fingers of one hand under the patient's chin and the other hand on the patient's forehead. Tilt the head backward, extending the neck. This movement opens the patient's

airway by moving the tongue from the back of the throat. In review, two fingers place under the chin lift up the head. Pushing on the forehead helps the two finger chin lifting technique to adequately tilt the head to open the airway.

Place your barrier device on the patient's face. Provide a breath, stopping when you notice chest rise. Chest rise is the best indication that the ventilation was deep enough to enter the lungs. If the chest does not rise, reposition the airway by completing another head-tilt chin-lift. Provide a second breath following the same steps.

During CPR, the goal is to stop compressions for as little time as possible. Rescuers should practice the skill of correctly providing two ventilations and returning to compressions in less than 10 seconds. **Continue this cycle of 30 compressions and two breaths until help arrives or the patient regains consciousness.**

Steps Review

- Check for safety of the scene. If needed, move the victim to safety.
- Check for responsiveness – Shake or tap, "Are you okay?"
- If someone else is present, have them call 911 and get AED. If no one else is present, shout for help.
- Check for signs of life to determine SCA: check for breathing. Advanced rescuers check for a pulse. No more than 10 seconds for this process is appropriate. Gasping is not normal breathing.
- Activate the emergency response system by calling 911 and retrieve an AED.

  For advanced rescuers: if there is a pulse but no normal breathing, provide rescue breathing ventilations at a rate of 1 breath every 5 – 6 seconds (10 – 12 breaths / minute). If not already done, call 911 after two minutes. Resume and check pulse every two minutes.
- If no breathing or only gasping and no pulse: Apply chest compressions and ventilations (30:2).
- Use an AED when it arrives on the scene.

Self-Knowledge Check
What is the appropriate compression to ventilation ratio for adult CPR? A) 15:2 B) 5:1 C) 30:2 D) 20:1 Answer: C

Youth

Children 1 – 8 Years

SCA in children is a rare event. While the ultimate goal of keeping blood flowing to the vital organs remains the same, the process changes slightly when helping children. The definition of a child for the purposes of CPR is any patient between 1 – 8 years of age. Under 1 is considered an infant. Some more advanced providers are taught to look for signs of puberty, such as chest or underarm hair for males, and breast development in females as the indicator for when a child has become an adult.

Two Minutes of Compressions

When assessing a child who appears to be in SCA, perform your assessment just as you would for an adult. If you find that the child is not showing signs of life, send someone to call 911 for help. **If there is no one else, it is recommended that you perform two minutes of CPR before leaving the child and calling 911 for help.** This is distinct from the recommendations for adults. For adults, call for help immediately if alone; for children in SCA, leave the child and call for help only after two minutes of CPR has been performed.

Press Down 1/3 – 1/2 Chest Depth

If you are alone, perform 30 compressions at a rate of no less than 100 per minute, just like the adult. **Because children are smaller than adults, use a depth of ⅓ to ½ the depth of the chest, do not exceed 2 inches.**

Ventilations

Open the airway with the head-tilt, chin-lift maneuver but only slightly extend the neck. The correct position looks as if the child is sniffing.

Provide two breaths by covering the child's mouth with yours while watching for chest rise, taking no more than 10 seconds to return to compressions. Pinch the child's nose closed while providing breaths.

Continue this 30:2 ratio until help arrives. If you are not alone and have someone able to help you, perform CPR as described but use a ratio of 15 compressions to 2 breaths. Remember to only provide enough breath to see visible chest rise. DO NOT overinflate the lungs. Repeat the process until the child is breathing on their own or until help arrives to provide emergency medicine.

Compression to Ventilation Ratio

- If alone, 30:2
- If assisted, 15:2

One Handed Compression

It is appropriate to use only one hand when doing compressions on a child. Place the other hand on the child's forehead to keep the head tilted back.

Steps

- Check for safety of the scene. If needed, move the victim to safety.
- Check for responsiveness – Shake or tap, "Are you okay?"
- If someone else is present, have them call 911 and get AED. If no one else is present, shout for help. (Do not leave the child until 2 minutes of CPR compressions have been performed. CPR starts after checking for signs of life in the next step.)
- Check for signs of life to determine SCA: check for breathing. Advanced rescuers check for a pulse. No more than 10 seconds for this process is appropriate. Gasping is not normal breathing.
- For advanced rescuers: if there is a pulse but no normal breathing, provide rescue breathing ventilations at a rate of 1 breath every 3 – 5 seconds (12 –20 breaths / minute) and call 911 after two minutes.

- If no breathing or only gasping and no pulse: Apply chest compressions and ventilations (30:2 unassisted, 15:2 assisted).
- If alone, after 2 minutes of CPR, activate the emergency response system by calling 911 and retrieve an AED. If alone and the the emergency response system is activated (by calling 911) and an AED is present, use the AED to analyze rhythm to see if there is a need for a shock.

Infants

Performing CPR on infants is very similar to the process with children. Continuing CPR for two minutes before leaving to call for help is identical as with children 1 – 8 years of age. Also, the depth of compressions (⅓ to ½ the depth of the chest) and the compression-to-ventilation ratios with two rescuers for children 1 – 8 are all appropriate for infants. The maximum depth for infants is approximately 1.5 inches. For infants, flick the bottom of the foot in an attempt to elicit a response to check for responsiveness.

The primary difference between children 1 – 8 and infants is the hand positioning used when performing compressions. When you are performing CPR, utilize the 2-finger technique by placing your index and middle finger on the center of the breastbone, between the nipples, pushing down on the chest. A second option is to use the two-thumb encircling-hands technique by wrapping your hands around the baby's body, overlapping your thumbs on the center of the breastbone. Squeeze your hands together performing compressions. If you are unable to achieve sufficient compression depth of ½ to 1/3 the depth of the chest using either of these techniques, it is appropriate to use the heel of one hand as you would in a child.

2-finger technique

2-finger technique

Two thumb encircling-hands technique

Knowledge Check

What is the age-range for using child CPR?

A) Birth – 3 years
B) 3 – 5 years
C) 0 – 10 years
D) 1 – 8 years

Answer: D

Automated External Defibrillators

What are They?

Automated External Defibrillators, or AED, is a device that determines if a patient in SCA needs an electrical shock and then delivers that shock. Recent research has shown that the use of an AED nearly doubles the chance of survival in SCA. They are safe and easy to use and should be used whenever possible during SCA.

How to Use Them

Once you have determined in your assessment that a patient appears to be suffering from SCA (unconscious, unresponsive, and displays no signs of life), you should attempt to find an AED while calling for help. When returning to the patient, use the AED as soon as it is available

The first step in using an AED is to turn the device on. Some units have an obvious power button while others turn on automatically when you open the case. Once you power up the device, instructions from the unit will begin. These instructions can be through a verbal recording or flashing lights but all AEDs will direct you in the proper steps to serve as a reminder when using them in emergency situations.

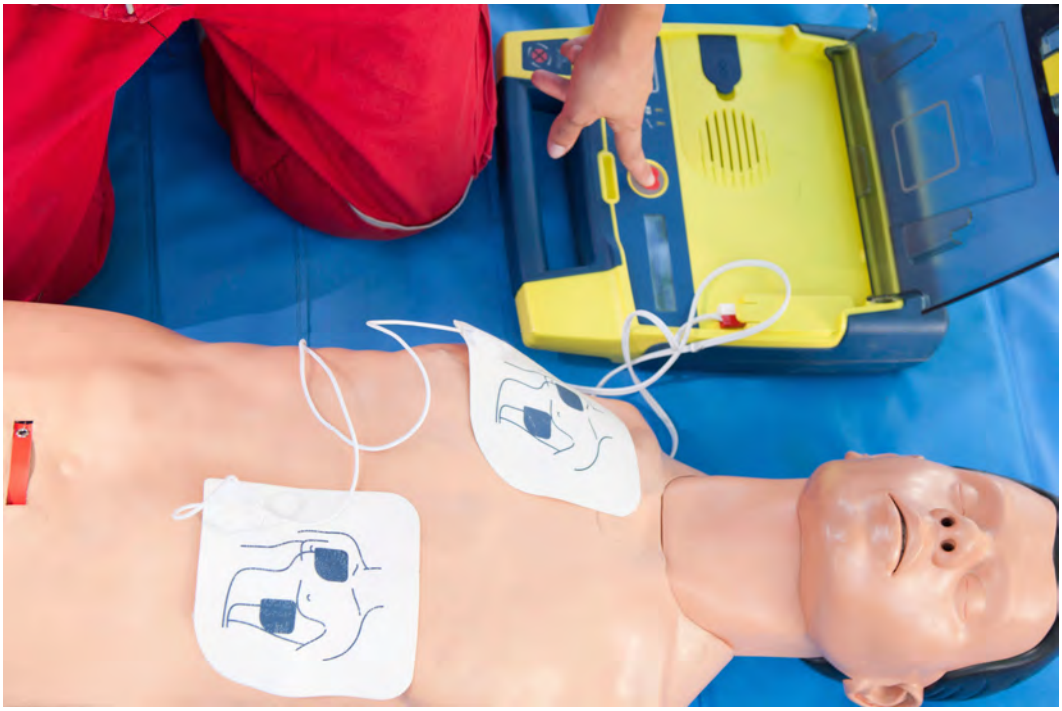
Once the device is on, you will be asked to apply the pads to the patient's chest. This requires you to expose the chest if you have not done so already during your assessment steps. Remove the backing from the pads and place one pad, sticky side down, on the right upper chest just below the shoulder. Place the other pad on the lower left chest just below the nipple (Image 5). Plug the pads into the device if they are not already plugged in. If there are multiple rescuers present, it is best to continue CPR while another rescuer applies the pads.

The AED will then direct you to clear the patient so it can analyze the heart rhythm. It is very important during this phase that you ensure that no one,

not even you, is touching the patient. During the pause, the computer inside the AED is reading the patient's electrical heart rhythm. If anyone is touching the patient during this it can cause the computer to misinterpret the rhythm and recommend an incorrect treatment.

Image 5: Place one pad on the upper right chest and the other on the lower left chest when using an AED. *Credit: Anita Hart CC / BY*

Once the AED has interpreted the patient's heart rhythm it will indicate whether a shock is advised or not. If a shock is advised, most AEDs will begin charging immediately (don't worry, it won't shock you during this). Other units require that you push a button to begin charging. Charging times differ for every unit with some newer units now pre-charging immediately once turned on. Recent research suggests that compressions be initiated during this charging time to reduce the amount of time compressions aren't being performed.



AED

The AED will sound an alarm when charging is complete and ready to shock. This provides you a reminder to ensure that everyone clears the patient. It is imperative that you look up and down the patient to be absolutely sure no one is touching the patient before pushing the shock button. Once you have ensured that everyone is clear, push the shock button on the AED. The AED will deliver an electric shock between the two pads to the patient. You will notice the patient's body arch upwards slightly or appear to jump. Once the patient's body has relaxed, the shock is over. Resume compressions immediately.

If the AED determines that a shock would not help the patient's current rhythm it will tell you that no shock is advised. Begin CPR for two minutes. This does not mean that your assessment of the patient and decision to start CPR was incorrect. It simply means that the patient's electrical rhythm would not be helped by an electrical shock and further treatment is necessary.

After delivering a shock or determining that no shock is needed, the AED will begin a two-minute countdown while you are performing CPR. At the end of two minutes it will remind you to check the patient. Check your

patient again for signs of life including evidence of breathing or movement. If no signs of life are present, allow the AED to analyze again and complete the process again. If signs of life are present, turn off the AED but leave the pads attached.

Special Considerations

Water

There is often a concern when using electricity around water. Modern AEDs are usually safe to use around water. It is not necessary to completely dry a patient wet from being exposed to water. Even wet pants are ok, though a wet shirt should be removed in order to apply the pads.

The largest concern when using an AED on a wet patient is the area where the pads will be applied. Using a towel, quickly wipe the chest to remove standing water on the chest where the pads will be placed. As long as the pads can firmly secure to the skin, the electrical current will flow through the patient between the two pads.

Medication patches

Sometimes you will notice medication patches on the patient's chest. The medicine under these patches is designed to absorb through the skin. If the location of the patches will make pad placement difficult, simply remove the patch and quickly wipe the area with a towel. If the patches do not interfere with pad placement, simply leave them in place.

When removing the patch, be careful not to touch the skin under the patch or the underside of the patch itself with your bare hands. The medicine, if it gets on your skin, can absorb through the hands and into your body causing unwanted effects.

Pacemakers

Some patients have had an internal pacemaker placed under their skin. These can often be seen by noticing a hard lump near one of the patient's shoulders about the size of a deck of cards. If the pacemaker is on the right side, do not place the AED pad on top of the device. Simply place the pad below or just to the side of the pacemaker.

Some pacemakers can also function as an internal defibrillator much the same way as an AED. You may even notice the patient jump slightly every few minutes as the internal defibrillator attempts to correct the patient's heart rhythm. This movement should not be considered a sign of life. In fact, it most often confirms your suspicion of SCA. When treating these patients, ignore these small jumps and follow the correct steps of CPR, using your AED when appropriate.

Body Hair

The presence of body hair itself does not present a problem when using the AED. In some patients, however, the amount of body hair prevents the pads from adhering to the patient's skin. When the pads do not make full contact with skin, the electrical shock is less effective and can cause burn injuries to the patient.

The most effective way to avoid this issue is to use a razor to quickly shave the area where the pads will go. Some AEDs come with a small response kit attached that includes a razor for this purpose. If there is no razor available but you have an extra set of pads available, place the first set of pads in the correct location, then quickly remove the pad. Discard these pads and use the second set with the AED.

Children

The use of AEDs in children and infants is acceptable. Many AEDs can be placed in a "pediatric" mode that decreases the amount of electricity delivered during a shock. This mode may be activated by a card you insert

into a designated slot. Some AEDs also recognize when a pediatric-sized pad has been plugged into the unit and automatically switches into pediatric mode. It is recommended that the pediatric mode be used for all patients under 8 years old.

If there is no pediatric mode available, or you cannot easily see how to use such a mode, you can continue to use the AED in the adult mode. While the amount of electricity delivered may be more than the patient needs, it is better than delivering no shock at all. When placing the adult pads on a pediatric patient, if the pads overlap when placed on the chest, place one pad on the right chest and the other on the patient's back directly behind the first pad.
It is important to understand that, while an adult unit or pads can be used on a pediatric, it is NOT acceptable to use a pediatric unit or pads on an adult. Only adult pads should be used for adults.

Knowledge Check

What is the first action you should take when arriving at the patient's side with an AED?

A) Turn the unit on
B) Place the pads on the chest
C) Call for help
D) Assess the patient

Answer: A

Knowledge Check

If you do are helping a child in cardiac arrest but do not have child AED pads with your AED, you should:

A) Wait for the ambulance
B) Use adult pads
C) Cut the pads down to size
D) Place one pad on the chest and the other on the abdomen

Answer: B

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