

First Aid and CPR

What CPR Means

Cardiopulmonary Resuscitation (CPR) is a lifesaving technique of providing compressions and ventilations to a victim of cardiac arrest.

How CPR Works

CPR works by rescuers providing chest compressions and ventilations to maximize blood and oxygen saturation to vital organs in the event of a sudden cardiac arrest (SCA). If CPR is administered within the first 3-5 minutes, it significantly increases survivability after a SCA by providing crucial blood flow and oxygen to the heart and brain.

Why CPR Matters

According to the Center for Disease Control (CDC), "About 610,000 people die of heart disease in the United States every year—that's 1 in every 4 deaths. Heart disease is the leading cause of death for both men and women." Unfortunately, this statistic includes children and infants.

Assess scene safety

The rescuer needs to first assess the safety of the scene, so as not to put themselves, the victim or others at risk. An example of assessing scene safety would be to ensure that no vehicles are coming into a busy intersection or crosswalk where a victim lies unresponsive.

Check for Responsiveness

The rescuer will then need to check the victim for responsiveness by shouting, "Are you okay?" and physically shaking the victim to see if there is a response. The rescuer should continually be assessing the victim for breathing by watching for chest rise and fall as well as listening and feeling for breathing. If the victim is not breathing and the rescuer cannot assess a pulse, a call for help should be placed.

Call for Help

If the victim is unresponsive, the rescuer will need to designate a bystander to call for help. If no bystander is available, the rescuer should call for help and then start CPR. After establishing contact with your emergency provider, the rescuer should place his/her phone on speaker, to listen for instructions while performing CPR.

Retrieve an AED

After the victim has been determined to be in need of CPR and additional help has been called, the rescuer will need to assign another bystander (if possible) to retrieve an AED if available.

Positioning

If the scene is safe and CPR is needed, place the victim on his/her back with the chest facing upwards on a hard surface, such as the floor or ground. Do not use a soft surface like a mattress. This will allow the rescuer to start compressions if needed.

Pulse Check

Check the carotid pulse of the victim. The carotid pulse is located between the sternocleidomastoid (muscle on the side of the neck) and the trachea (windpipe). Press with 2-3 fingers and feel for a pulse on the side of the neck closer to the rescuer. At the same time, assess the victim for breathing by watching for chest rise and fall.

Checking for a pulse should take at least 5 seconds, but no longer than 10 seconds.

Special Considerations for Infants and Children

Infants: Check an infant's pulse at the brachial artery located in the center of the inner, upper arm.

Children (Ages 1-8): Check a child's pulse at the femoral artery located in the inner thigh between the hip bone and pubic bone.

Starting Compressions

If a victim requires CPR compressions, a rescuer will first have to find a landmark to place his/her hands. Clothing should be removed from the chest to make this area visible. The rescuer should move to the side of the victim.

The heel (palm) of the bottom hand needs to be placed on the sternum (breast bone) along the lower half of the bone (nipple line or slightly below). Then take the heel of the other hand and place it on top of the bottom hand with both arms straight. Next compress the chest downward at least 2 inches for 30 compressions. Each set of 30 compressions will be followed by 2 ventilations (30:2 compression-to-ventilation ratio), which completes 1 cycle. Each compression should allow full chest recoil (the re-expansion of the chest, allowing blood flow to the heart). The goal is to perform 100-120 compressions per minute and at least 5 cycles per 2 minutes before switching partners (in multi-rescuer CPR) to avoid fatigue.

Special Note: If the correct hand position cannot be achieved, an alternative technique would be to use the first hand in the same position and the second hand wrapped around the wrist of the first.

Quick Tip: Compress to the beat of *Stayin' Alive* by the Bee Gees to achieve between 100-120 compressions per minute.

Compressions are the first step in performing: **C-A-B**

- Compressions
- Airway
- Breathing

Hands Only CPR

Hands only CPR may be recommended if the proper Personal Protective Equipment (PPE), such as a barrier device, gloves, gown, etc. is not available. Hands only CPR involves compressions without ventilations.

Infants

Infant compressions are completed at the same rate as compressions for children. However, the landmarks and hand positioning are different. **Single rescuer** infant compressions should be performed with two fingers on the center of the lower chest, on the lower breast bone just below the nipple line. **Multiple rescuer** infant compressions should be performed with the encircling hands technique (wrapping hands around the infant's chest), using both thumbs to compress at the same location.



Children (Ages 1-8)

Compressions for children should be performed using the same landmark and hand position as adults. The **single rescuer** CPR compression ratio of **30:2** compressions-to-ventilations is the same in children and infants as it is in adults. However, the compression-to-ventilation ratio for **multiple rescuer** CPR for children and infants is **15:2**. The compressions per minute rate remains the same (100-120). Compressions should be performed on children to a depth of approximately 1 ½ inches or 1/3 of the depth of the chest.

Pocket Mask (Barrier Device)

A pocket mask or barrier device should be used anytime ventilations are given. The pocket mask is a barrier device with a 1-way valve that allows air to pass into the victim's airway and not back to the rescuer. The mask should be placed over the victim's nose and mouth with the rescuer using the index finger and thumb of the hand closest to the forehead to secure the top of the mask. The bottom of the mask should be secured by pressing downward against the chin to complete a seal around the airway. Once the seal has been created, the rescuer can breathe into the tube, pushing air into the lungs of the victim.



Bag Valve Mask (BVM)

A bag valve mask is a ventilation device that utilizes a bag and a 1-way valve to provide better ventilation assistance to a victim. This device, used in single or multiple rescuer CPR requires a sealing technique called the E-C clamp.

E-C Clamp Technique

The E-C clamp technique is used to create a seal over the victim's mouth and nose. The E-C clamp technique is completed in the following manner: One hand of the rescuer should be placed on the mask with the thumb and index finger holding the mask over the nose and mouth (the C shape), and the remaining three fingers grasping the jaw (the E shape) to complete the airway seal. With the remaining hand, the rescuer should squeeze the bag portion of the BVM, giving each breath for 1 second.

Special Considerations for Infants and Children

Pocket masks and BVMs are made in adult, child and infant sizes. Be sure the pocket mask or BVM is age appropriate for the victim, fits securely and forms an airtight seal.

Head-Tilt-Chin-Lift Maneuver

To ventilate an adult victim, the rescuer will need to open the airway using the head tilt-chin-lift maneuver. This method is completed by placing one hand on the victim's forehead, tilting the victim's head backwards, while taking two fingers from the other hand to lift the chin up. This maneuver will align the victim's airway and allow for oxygen to pass into the lungs. If there is any visible airway obstruction that is safely and easily removable, remove or move aside the blockage (the tongue is the most common). Chest rise should be visible if rescue breaths are completed correctly.

As covered, a barrier device should always be used when giving ventilations. Ventilations should be given at a rate of 2 breaths per every 30 compressions, with each breath given for 1 second. In many cases, cardiac arrest is preceded by respiratory arrest. If an adult victim has quit breathing but still has a pulse, rescue breaths should be given at a rate of 1 every 5-6 seconds.

Fast Fact: Exhaled air contains approximately 17% oxygen and can still be used to sustain life in a victim.

Quick Tip: The head tilt-chin lift method should not be used if trauma is suspected.



Single Rescuer Ventilations

When using a bag valve mask (BVM) or a pocket mask in a single rescuer setting, the rescuer should start by positioning themselves at the head of the victim and place the mask over the nose and mouth of the victim. The rescuer should use the E-C Clamp to complete the seal of the mask. The rescuer will then deliver a breath for 1 second.

Multiple Rescuer Ventilations

In a multiple rescuer situation with a BVM, one rescuer should be positioned at the head of the victim with both hands on the mask using the E-C Clamp technique to ensure a proper seal. The second rescuer will then deliver a breath for 1 second by squeezing the bag portion of the BVM.

Airway and Breathing are the second and third steps in performing: **C-A-B**

Compressions

Airway

Breathing

Infants

Ventilations for infants also use the head-tilt-chin-lift maneuver. However, special considerations apply. Infants have a larger head in proportion to their body than adults and children. Consequently, an infant's head should not be extended back past the "sniffing" position, which is slightly tilted back from neutral. Excessive head tilt could cause a blockage of the airway.

As mentioned above, the compression-to-ventilation ratio for infants and children with **single rescuer** CPR is **30:2**. In **multiple rescuer** CPR, the ratio is **15:2**.

Special Note: As in adults, cardiac arrest can be preceded by respiratory arrest. If an infant or child victim has quit breathing but still has a pulse, rescue breaths should be given at a rate of 1 every 3-5 seconds.



Children

Ventilations for children also use the head-tilt-chin-lift maneuver. However, the compression-to-ventilation ratio is different. As mentioned in the compressions chapter, the compression-to-ventilation ratio for infants and children with **single rescuer** CPR is **30:2**. In **multiple rescuer** CPR, the ratio is **15:2**.

AED

An Automated External Defibrillator (AED) is a portable device used to detect cardiac rhythms and, if necessary, administer a shock to restore a normal heartbeat. During CPR, if an AED is brought to the scene for a rescuer to utilize, the first action should be to open the case and power on the device, unless the device powers on automatically when opened. AED pads have images to show correct placement. Remove the plastic film to expose the adhesive side of the pads and attach them to the victim.

Quick Tip: Usually, AED adult pads can be used on victims 8 years and older.

AED Steps

- Turn on the AED
- Plug in the AED pads and place them on the victim
- Clear any contact with the victim to allow the AED to analyze the heart rhythm and listen for the AED's prompts
- The prompt will be either "No Shock Advised" or "Shock Advised"
- If the prompt is "Shock Advised", the device will give a warning of "Clear" before shocking
- Once "Clear" is heard, clear any contact with the victim and press the "Shock" button, then listen for the prompt to continue CPR
- If the prompt is "No Shock Advised", perform CPR for 5 cycles and then reanalyze

Special Considerations for Infants and Children

Special AEDs and/or AED pads are made for children and infants. An adult AED and/or AED pad should not be used on a child under the age of 8 or an infant.

When to Alter AED Application

Hairy Chest

If a victim has a hairy chest, check the AED for a razor or second set of pads. If a razor is available, shave the areas of the chest to allow the pads to stick. If no razor is present, but a second set of pads are, take the first set of pads and place them onto the victim. Then forcibly remove the pads, ripping the hair from the chest. Now the second pads can be used without interference.

Victim in Water

If a victim is in water, remove him/her from the water and quickly dry him/her. Because water is a good conductor of electricity, the victim needs to be as dry as possible before an AED is used.

Implanted Device (Defibrillator, Pacemaker, etc.)

If a victim has an implanted device like a defibrillator or pacemaker, note the device and avoid placing the pads over the implanted devices.

Transdermal Patch

If the victim has a transdermal medication patch, remove the patch and wipe away as much of the medication as possible before applying the AED pads.

Special Considerations for Infants and Children

Special AEDs and/or AED pads are made for infants and children under the age of 8. Do not use an adult AED and/or adult AED pads on a young child or infant.

- Not checking for scene safety before starting CPR
- Not calling for help before starting CPR
- Compressing at the wrong speed (usually too slowly)
- Not exerting enough force on the compressions
- Not allowing full chest recoil between compressions
- Bending elbows during compressions
- Using an incorrect compressions-to-ventilation ratio
- Treating non-life threatening wounds before starting or while performing CPR

Conclusion

The best outcome for a victim is contingent on early recognition, quick action and notification of medical professionals. Compression depth and recoil should be monitored along with proper ventilation rates and technique to increase survival chances. AED can be life saving, so attempt to have one available as quickly as possible. CPR can be a scary process, but **YOU** are able to assist the victim. Remember **C-A-B**.

1. **C**ompressions (100-120 per minute)
2. **A**irway (head-tilt and chin-lift)
3. **B**reathing (E-C clamp, barrier device)

Glossary & Abbreviations

Acquired Immune Deficiency Syndrome: The deterioration of the immune system caused by the Human Immunodeficiency Virus (HIV)

Allergic Reaction: A reaction of one's body to a foreign substance that causes that body to swell, itch, cause a rash

American Heart Association (AHA): An association that creates CPR and first aid guidelines

American Red Cross: An association that creates first aid and CPR guidelines

Analyzing: A prompt from the AED that alerts the rescuers that the device is checking the victim for a sustainable rhythm

Arterial Bleeding: The most serious type of external bleeding resulting from a damaged artery

Automated External Defibrillator (AED): An electrical device that delivers doses of energy to engage the heart muscle back into a sustainable rhythm

AVPU: Alertness, Verbally responsive, Pain responsive or Unresponsive

Axillary Region: The area between the upper limbs and thorax - armpit area

Bag Valve Mask (BVM): A ventilation device that utilizes a bag and a 1-way valve to provide better ventilation assistance to a victim

Barrier Device: A thin plastic device used during mouth-to-mouth ventilations that provides limited exposure protection

Beats Per Minute (BPM): A term used to define the amount of heart contractions per minute

Blind Finger Sweep: Blindly attempting to sweep a foreign body from a victim's airway

Bloodborne Pathogen: An infectious microorganism that can be potentially dangerous if an individual comes into contact with it

Body Substance Isolation (BSI): The process of protecting oneself against harmful microorganisms

Brachial Artery: A large artery that is used to obtain a child's pulse, located in the inner, middle portion of the upper arm

Capillary Bleeding: Surface bleeding that is easily controlled

Capillary Refill Time (CRT): The time it takes color to return to an external capillary bed

Cardiac Arrest: The failure of the heart to beat

Cardiopulmonary Resuscitation (CPR): The active engagement of compressions and ventilations for a victim suffering from a sudden cardiac arrest

Carotid Artery: A large artery that is used to obtain an adult's pulse, located between the trachea and the sternocleidomastoid

Chest Recoil: The re-expansion of the chest, allowing blood flow to the heart

Child: A person ages 1 through puberty

Clear: A prompt from the AED that alerts the rescuers to clear the victim for the administration of a shock

Compressions: The act of pushing on the chest to resuscitate a victim

Compressions-Airway-Breathing (C-A-B): A sequence of events to conduct CPR

Contaminated Sharps: Contaminated needles and objects that represent a penetration hazard

CPR: Cardiopulmonary Resuscitation (CPR) is a lifesaving technique of providing compressions and ventilations to a victim of cardiac arrest.

Defibrillation: An electrical impulse used to eliminate abnormal, rapid heartbeats and re-establish a normal heart rhythm

Dehydration: A harmful reduction in the amount of water in the body

E-C Clamp: A technique used to secure a pocket mask or BVM where the thumb and index fingers form the C shape and the remaining three fingers form an E shape

Emergency Cardiovascular Care (ECC): A term used to define immediate recognition and care concerning a cardiovascular emergency

Encircling Hands: A technique used in multiple rescuer CPR for infants involving wrapping hands around an infants body and compressing with the thumbs

Epinephrine (Epi): A drug most commonly used to stop an allergic reaction

Epi Pen: An auto-injection device most commonly used to address a severe allergic reaction

Epistaxis: A nose bleed

Femoral Artery: A large artery that is used for obtaining a child's pulse, located in the upper, inner thigh

Foreign Body: An unknown obstruction to the airway

Human Immunodeficiency Virus (HIV): A microorganism that attacks the immune system causing Acquired Immune Deficiency Syndrome (AIDS).

Hepatitis B: A virus that attacks the liver and causes severe pain

Hepatitis C: A virus that attacks the liver and commonly shows little to no signs

Infant: A person who is less than 1 year old

Injury Prevention: A system of checks and balances to ensure a workplace is in the safest possible order

Mucous Membrane: A membrane tissue that often lines body cavities and secretes mucous

Multiple Rescuer: A team of at least 2 members that are conducting rescue efforts for a victim

National Highway Traffic Safety Administration (NHTSA): A government organization that monitors traffic safety on highways.

No Shock Advised: A prompt from the AED to alert the rescuers that the device does not detect a shockable rhythm

Occupational Health & Safety Association (OSHA): The governing body that oversees the workplace for safety and health standards

Personal Protective Equipment (PPE): The equipment used to protect yourself against harmful microorganisms, such as gloves, gowns, caps, boots and masks

Pocket Mask: A mask device that can be used during mouth-to-mouth ventilations providing better exposure protection by use of a 1-way valve

Rescuer: The individual engaging in rescue procedures for a victim

Respiratory Arrest: The failure to breathe

Responsiveness: The active involvement of a victim as classified by Alertness, Verbally responsive, Pain responsive or Unresponsive (**AVPU**)

RICE: Rest, Ice, Compression, Elevation

Risk Management: An index of suspicion of potential risk and mitigation of those risks to prevent accidents

Seizure: An uncontrolled disturbance in the brain, most commonly identified as convulsion-type movements

Shock: A potentially fatal decrease in blood flow that causes the body to become pale with low blood pressure and a weak pulse

Shock Advised: A prompt from the AED that alerts the rescuers that the device does detect a shockable rhythm

Single Rescuer: A single individual conducting rescue efforts for a victim

Sniffing Position: A head position with a slight tilt, as if lifting the head slightly to sniff

Source Individual: An individual with a known harmful microorganism, such as HIV, Hep B, Hep C, AIDS, etc.

Stroke: A condition caused by a clot or bleed within the brain that decreases the blood flow to the brain, potentially causing possible function paralysis

Sternocleidomastoid: A large muscle on the side of the neck which can be used to determine the position of the carotid artery

Sudden Cardiac Arrest (SCA): An incident that occurs when the heart stops beating abruptly and without warning.

Trachea: An airway referred to as the '*windpipe*' which can be used to determine the position of the carotid artery

Tourniquet: A device used to help control bleeding when direct pressure is not effective

Universal Precautions: Refers to standard procedures used to avoid contact with blood and other bodily fluids

Venous Bleeding: A serious type of external bleeding resulting from a damaged vein

Ventilations: The act of assisting a victim with breathing

Victim: The individual suffering from an emergency incident

Xiphoid Process: A small cartilaginous process that projects from the lower end of the sternum