CPR – Cardiopulmonary Resuscitation

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Purpose The purpose of this course is to outline the American Heart Association's guidelines for CPR, the use of AEDs, and the Heimlich maneuver.

Goals Upon completion of this course, the healthcare provider should be able to:

- Discuss Good Samaritan laws.
- Explain the use of compressions only CPR.
- List 3 different CPR protocols.
- Explain the protocol for Compressions-airway-breathing (CAB) CPR.
- Explain the protocol for ABC CPR and indications.
- Explain the use of AEDs.
- Explain how to perform the Heimlich maneuver on conscious and unconscious victims (infant, child, and adult).

Introduction

In 2010, the American Heart Association changed the guidelines for cardiopulmonary resuscitation (CPR), including a compression-only protocol for lay people or people untrained in CPR, to encourage more people to attempt CPR in emergency situations. Guidelines for the Heimlich maneuver for choking remain essentially unchanged.

If providing CPR is part of a healthcare provider's duties, then that person has a legal obligation to do CPR. However, if it's not part of the person's duty, then that person may have an ethical but not a legal obligation.

CPR is only administered to people who are unconscious, and in that case, consent is implied. If the person needing CPR is a child and a parent or legal guardian is present, then the person able to administer

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CPR should ask permission to proceed. However, if the guardian or parent is not present, again consent is implied.

All 50 states have some form of "Good Samaritan" law, but the laws vary somewhat from one state to another. Some state laws are directed only at healthcare professionals while others are more encompassing; however, the reality is that those who administer CPR are virtually always protected from liability if they follow simple guidelines:

- The person is attempting to administer aid.
- The intervention is reasonable and does not involve misconduct or gross negligence.
- The person receives no specific compensation (including a reward).

At one time, there was essentially, one protocol for CPR--A (airway), B (breathing), and C (Circulation/Compressions), but now there are three: C, CAB, and ABC. A notable change is the relationship between compressions and breathing. In earlier protocols, "look, listen, and feel" with 2 rapid breaths was done prior to beginning compressions; but now, in most cases, compressions are done first.

C (Hands only)	CAB (Trained)	ABC (Trained)
Adults with sudden arrest.	Adults with sudden arrest. Infants. Children	Adults with respiratory arrest, such as related to drug overdose, drowning. Newborns.

The AHA has identified 5 'links" in the "Adult Chain of Survival":

1. Immediate recognition of cardiac arrest and activation of the emergency response system.
2. Early CPR with an emphasis on chest compressions.
3. Rapid defibrillation.
4. Effective advanced life support.
5. Integrated post–cardiac arrest care.

Compressions (Hands only)

Adults only!!

Compressions (hands only) is effective for adults who are likely to experience cardiac arrest because of cardiac arrhythmias but is not advised for infants

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and children, who more often suffer from respiratory arrest and need the airway cleared and oxygenation. In fact, a review of cardiac arrests in children shows that compressions only for infants and children is no more effective than no CPR at all.

Because bystanders are often unsure about procedures and reluctant to attempt mouth-to-mouth breathing, the compressions only procedure is easier to carry out for those without training.

When people encounter a person in cardiac arrest as evidenced by lack of responsiveness and no breathing or gasping only (which may be a reflexive movement), laypersons should evaluate based on responsiveness and breathing only because most are not trained to palpate pulses and may waste valuable time searching for a pulse or mistakenly feel their own pulse.

However, healthcare providers should evaluate for pulse as well but should spend no more than 10 seconds doing so. The carotid pulse in the neck is usually the best place to assess pulse. If no pulse is felt, and there is no evidence of normal breathing, then the compressions only protocol is followed.

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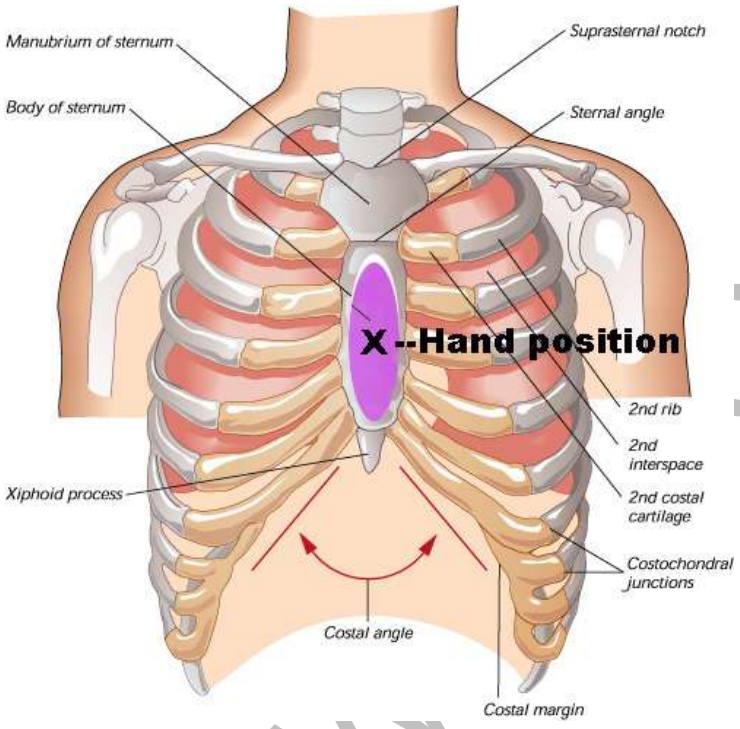
1. Call 9-1-1 or ask someone else to do so in order to activate an emergency response. Shout for help if no phone available.
2. Begin CPR with compressions at the rate of at least 100 per minute. (Do not delay compressions while waiting for the AED and interruptions should be less than 10 seconds).
3. Get defibrillator as soon as possible if one is readily available or ask a bystander or second rescuer to retrieve it and follow procedures for shocking, repeating every 2 minutes as needed with immediate resumption of compressions after each shock.
4. **Note**: interrupt CPR to use defibrillator if one becomes available after compressions have started.

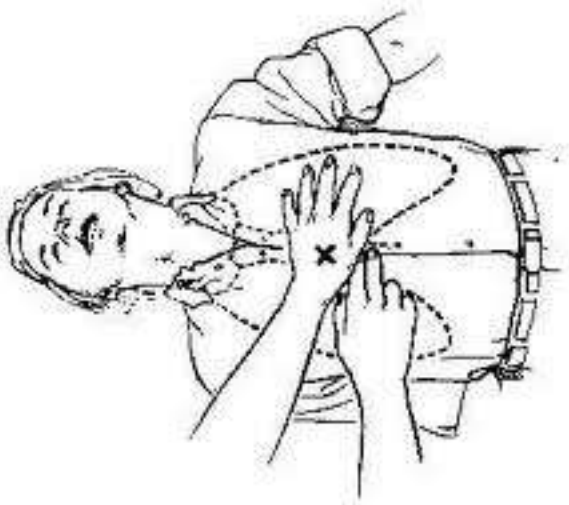
The rescuer should also ascertain the time CPR begins, if possible, so the duration of the rescue attempt can be documented. For a witnessed arrest in which an adult suddenly collapses, one can assume

the body was adequately oxygenated and will remain so for a few minutes (the same as if someone holds his breath while swimming underwater), long enough to call 9-l-l and get a nearby defibrillator.

Prior to beginning compressions, the victim must be placed on his or her back on a hard surface, such as the floor. In a medical facility, a backboard may be placed behind the victim. Compressions must be over the sternum, avoiding the xiphoid process, which can easily break.



The easiest method of finding the correct hand position is to run two fingers along the ribs to the center chest, place two fingers over the xiphoid process, and place the palm of the other hand on the sternum directly above the fingers.



The hand position is usually between the nipples unless the breasts are large and/or pendulous. Once the correct position is found, the other hand is placed on top of the first, fingers linked, and elbows locked to begin compressions.

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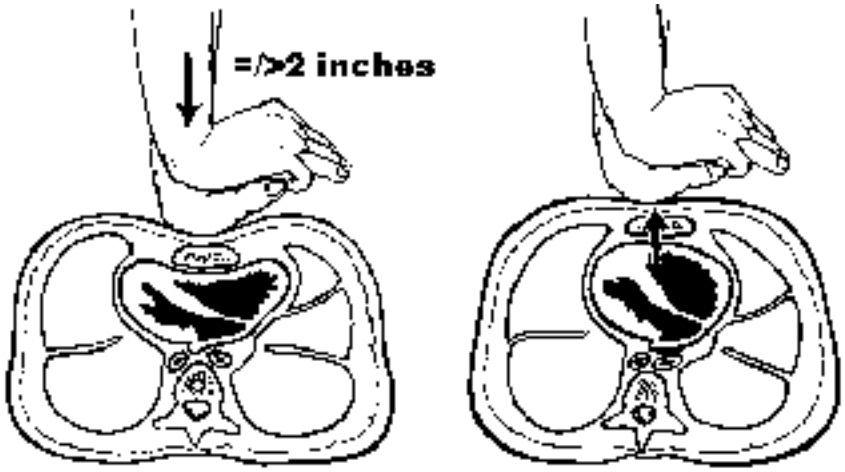
Compressions should be done in a rocking movement, using the body to apply pressure rather than just the arms. The arm should not flex during compressions but should remain locked. Attempting to give compressions using the force of the arms only cannot provide adequate depth of compression.

The rate of compressions is **AT LEAST 100 per minute,** hard and fast**.** This rate corresponds roughly to the beat of the Bee Gees' song "Staying Alive" (Dum, dum, dum, dum, stayin' alive, stayin' alive….)

In previous protocols, rescuers were advised to compress the chest 1.5 to 2 inches, but this is no longer the case. Current protocol requires compression of **AT LEAST 2 INCHES.** If people are obese or very large, deeper compression may be necessary.



The chest should be allowed to completely recoil between each compression to allow the heart to refill, but the rescuer should keep the hands in contact with the chest because lifting the hands can result in the hands bouncing around to different spots and ineffective compressions.

One problem that is common with CPR, especially for older adults, is that the ribs will break during compression, and the rescuer may feel the ribs snap. While this is disconcerting, rib fractures are generally not life threatening but cardiac arrest is. Fractures are more likely to occur if the rescuer does not maintain the hands in the correct position over the sternum. Approximately one-third of those undergoing CPR experience fractures.

The rescuer should continue to give compressions at the same rate until the patient begins breathing independently and has a pulse, the rescuer is relieved by emergency medical personnel, or until the rescuer is no longer physically able to continue.

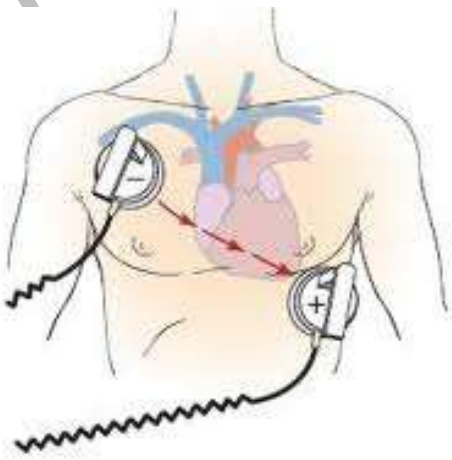
NOTE: The previous guidelines of "look, listen, and feel" are no longer used for any of the protocols. This is replaced by brief observation of breathing consciousness to determine if CPR is necessary. The compressions only protocol is not intended for trained medical personnel, who should use the CAB or ABC protocols as appropriate.

Studies conducted in 2010 found that the one-shock protocol followed by immediate resumption of CPR was more effective than 3 stacked shocks.

AED/Defibrillation

Automated external defibrillators (AEDs) are electronic devices that are used to defibrillate or shock the heart. AEDs found in the public arena, such as in malls and offices, are less sophisticated than most defibrillators used in hospitals, but they are easy to use and have simple directions usually printed on the machines.

Typically, an AED kit contains cutting shears to cut through clothing and expose the chest, a barrier device for mouth to mouth ventilation, gloves, a razor for shaving hairy chest, and towels to wipe away moisture. Bras with metal wires and any metal piercings on the chest should be removed prior to defibrillation to prevent arcing.



The electrode pads have pictures to show placement. Once the pads are in place, the machine automatically examines the heart rhythm and determines if a shock is warranted. Ideally, defibrillation should be done within 3 minutes of arrest.

While machines vary somewhat, all approved AEDs in the U.S. provide a spoken message to guide rescuers through the defibrillation process, including advising rescuers to avoid touching the person and to press a button to deliver the shock for some machines.

Fully automated AEDs automatically administer the shock. The AED then usually reevaluates and provides instructions to continue CPR or administer another shock. Adminstering defibrillation with an AED in emergency situations is covered by Good Samaritan laws.

Compressions-Airway-Breathing (CAB)

Adults The new protocol for CPR requires a change from ABC to CAB. The single trained rescuer is now advised to give 30 compressions at the rate of at least 100 per minute (as above) before giving two rescue breaths and then continuing at the rate of 30:2. The same rate of 30:2 is used with two rescuers for adults.

Most witnessed cardiac arrests in adults result from ventricular fibrillation or pulseless ventricular tachycardia, so compressions are essential, and the time spent clearing the airway, applying a barrier, and beginning ventilation delays this critical need.

Additionally, for out of facility arrests, beginning CPR with compressions is less daunting and gives the rescuer time to think and respond. The rescuer should not insert fingers into the victim's mouth to clear it unless food or other material is clearly evident and might be aspirated during ventilation.

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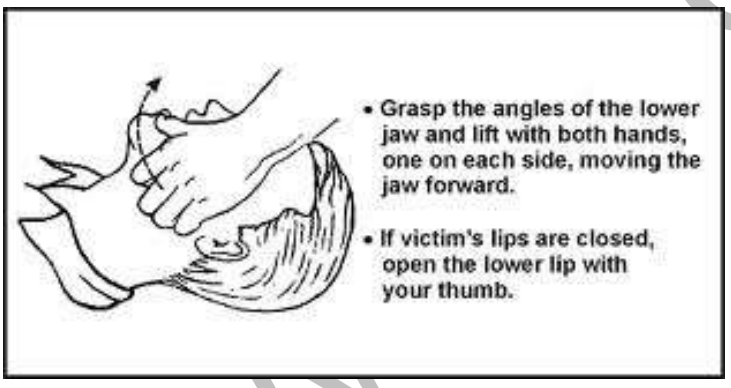
1. Call 9-1-1 or ask someone else to do so in order to activate an emergency response. Shout for help if no phone available.
2. Begin CPR with 30 compressions at the rate of at least 100 per minute. (Do not delay compressions while waiting for the AED.)
3. Rapidly open airway.
4. Give 2 ventilations and resume compressions.
5. Get defibrillator if one is readily available and follow procedures for shocking, repeating every 2 minutes with immediate resumption of CPR (for 2 minutes) after each shock.
6. Continue at rate of 30 compressions to 2 ventilations (30:2). For infants and children, the rate is 30:2 for one rescuer and 15:2 for two rescuers.
7. If bag valve mask available for ventilation, ventilate about every 10 compressions (8 to 10 times a minute).
8. Note: interrupt CPR to use defibrillator if one becomes available after compressions have started.

For ventilation, the rescuer extends the victim's neck to open the airway and begins by placing one hand on the forehead and lifting the jaw with the other.

When the airway is opened, the rescuer then moves one hand from the forehead to pinch the nostrils and maintains jaw position with the other while placing his or her mouth completely over the victim's mouth to seal air in and blowing air into the victim.



If a spinal cord injury is suspected or there are maxillofacial injuries, the jaw thrust may be substituted; however, this maneuver is not recommended for untrained rescuers.

The rescuer should blow in, lift the mouth to allow the victim to exhale air, and then repeat. A rescue breath should be given for about one second.

In some cases, such as when there is vomitus in the mouth, the victim was drowning, or maxillofacial injuries are present, mouth to nose breathing may be done by holding the mouth closed so air doesn't escape and placing the rescuers mouth in a tight seal about the

nose.

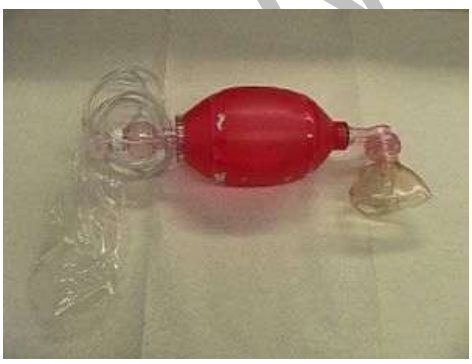
If CPR is performed by a single person, then the person should give two rapid breaths and immediately resume compressions. If a second person is giving ventilations, the person giving compressions should maintain the rate of compressions.

If there is more than one trained rescuer, then one rescuer can check the radial or carotid pulse during compressions to determine if the compressions are effective enough to generate a pulse.

NOTE: Mouth-to-mouth resuscitation is rarely done by medical personnel except in emergency situations outside of the hospital. In hospitals or other medical facilities, CPR rescue kits should be available on crash carts with CPR pocket masks and/or bag valve masks to facilitate ventilation.

All staff should be familiar with the equipment available in their units, where it is, what it is, and how to use it. Various types of barrier protections are available, including portable key-ring sized face shields.

Masks generally provide one-way valves to prevent cross-contamination so that the air goes in but substances, such as vomitus, don't come out.



If a bag valve mask is available, then ventilations should be interspersed with compressions about every 6 to 8 seconds (8 to 10 times per minute or between about every 10 compressions). Bag valve masks are available in different sizes (infant, child, adult)

NOTE: The general recommendation for AED defibrillation is to immediately begin CPR and then use the AED as soon as possible. Usually, if an AED is available in a public site, there are other people present, so the rescuer should begin CPR and have someone else

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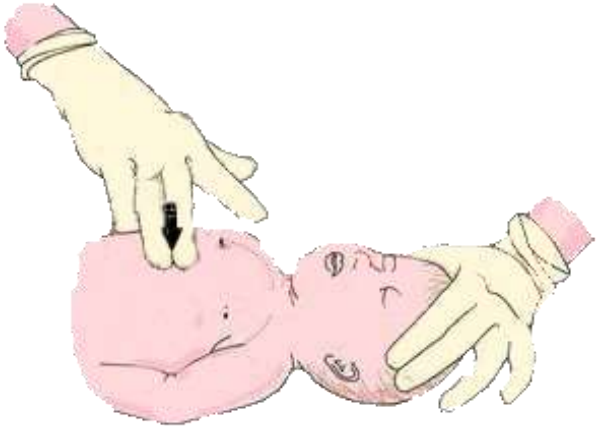
retrieve the AED if possible rather than leaving the victim to retrieve the equipment.

Infants and children



When giving compressions to **infants and children**, the compressions should go to a depth one-third the anterior-posterior diameter of the chest. For an infant, this is usually about 1.5 inches and for children about 2 inches. Compressions must be done on a hard surface, such as a table or countertop.

For infants, compression should be done with two fingers, and for young children with one hand to avoid crushing the chest. The alternate hand should be placed on the child's forehead to maintain an open airway. The rate of compressions is the same as for adults—at least 100 per minute—at a rate of 30:2 for one rescuer and 15:2 for two rescuers.

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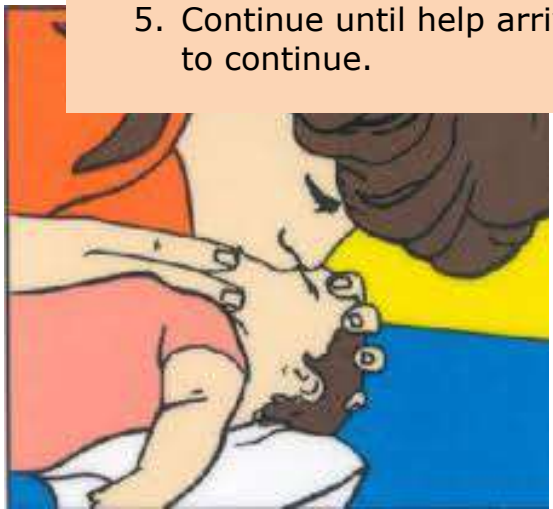
1. Shout for help and ask someone to call 9-1-1 and get an AED if available.
2. Immediately begin CPR with compressions and continue at rate of 100 per minute.
3. Open airway, ventilate twice and continue CPR at rate of 30:2 for one rescuer and 15:2 for 2 rescuers for at least 2 minutes before stopping to call 9-1-1 (if alone) or getting/using the AED.
4. Use AED for defibrillation if available and immediately resume CPR for 2 minutes between subsequent shocks.
5. Continue until help arrives, child recovers, or physically unable to continue.



Because an **infant** (12 months or younger) has a narrow airway, extending the head too far may result in airway obstruction, so the head

should be extended into the "sniffing" position, far enough back so the infant looks like he or she is sniffing. Infant's breathing may be quite shallow, so careful observation of the chest is necessary to evaluate breathing.

With infants and small children, the rescuer places the mouth over the infant's nose and mouth and puffs with air from the cheeks rather than a deep blowing of air, which might overextend the lungs.

Healthcare providers can check an infant's pulse at the brachial artery, which is located inside of the upper arm, between the elbow and the shoulder. For children, the carotid or femoral pulse can be checked by trained rescuers. However, because even healthcare providers can have difficulty finding a pulse, the new protocol de-emphasizes the importance of checking for pulse and stresses that the healthcare provider should spend less than 10 seconds assessing pulse prior to beginning CPR.

Under new AHA protocol, AEDs may be used on infants and children. For those 1 to 8 years old, a pediatric dose-attenuator system should be used if available, but if not, a standard AED can be used. For infants less than 12 months, a manual defibrillator should be used if available. The second choice is an AED with a pediatric dose-attenuator system, but if neither are available, a standard AED may be used.

Airway-Breathing-Compressions (ABC)

The ABC protocol is recommended for only a few specific instances, including for resuscitation of newborns because arrests in the newborn are almost always asphyxial. Unlike with sudden cardiac arrest, when the arrest is precipitated by respiratory arrest and suffocation, the level of oxygen in the blood is low, so any further delay can be life threatening; therefore, CPR should begin before activating an emergency response (calling 9-1-1) or retrieving an AED.

For **newborns**, the basic methods of opening the airway, breathing, and compressions are the same as for infant CPR, but CPR begins with ventilation (2 puffs) and a compression to ventilation rate of 3:1 with each event (compression, ventilation) taking about ½ second, so that there are about 90 compressions and 30 breaths per minute.

Ventilation should be done quickly as soon as a compression ends so that the infant exhales with the next compression. If the arrest is likely related to a cardiac event, such as may occur with some congenital

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cardiac abnormalities, then the 15:2 rate of compressions to ventilation is used.

1. Ventilate with 2 puffs.
2. Continue with compression to ventilation rate of 3:1 (each event ½ second) if asphyxial or 15:2 if cardiac.

Another instance when the ABC protocol is used is with victims of **drowning** because the heart stops because of suffocation. In this case, opening the airway and ventilating the lungs takes priority, so rescue breaths (two) should be done before beginning compressions, which then continue at the 30:2 rate. CPR should begin while the victim is still in the water. In that case, the rescuer should continue giving ventilations until the victim is out of the water and compressions can begin. Additionally, usually about two minutes of CPR are completed prior to using an AED because the heart may function normally if oxygenation is adequate.

A third indication for the ABC protocol is **drug overdose**. Many opiates depress respirations, so victims of a drug overdose may go into respiratory arrest resulting in a lack of oxygen to the heart. Protocol is similar to that for drowning.

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Heimlich maneuver

The universal sign of choking is when a person clutches the throat and appears to be choking or gasping for breath. If the person can speak ("Can you speak?") or cough, a Heimlich maneuver is not usually necssary, but if the person is not able to cough or make sounds, then prompt action is critical to clear the airway.

Most choking deaths occur in older adults and children under 3, but anyone can become of victim of choking, especially if people are eating and talking, such as may happen at a restaurant..

Adults If the victim is **conscious and sitting or standing**, yell for someone to call 9-1-1 but do not delay action to place the call.

Abdominal thrusts:

- Stand behind the victim, wrapping the arms around the person's waist, keeping the elbows bent.

- Make a fist with one hand and place the thumb side of the fist against the victim's abdomen, midline and slightly above navel area but below the xiphoid process.

- Grasp the fisted hand with the other and quickly thrust upward to elevate the diaphragm, forcing air out of the lungs with pressure to expel the foreign body.

- Continue distinct, separate thrusts until patient expels foreign body or help arrives or the victim loses consciousness.

- If the victim loses consciousness, ease the person onto the floor in **supine position** and kneel astride or straddle the person's thighs.

- Do a finger sweep using care not to stick the finger down the throat as this may force the foreign object further down the throat and cause more obstruction, open airway, and try to ventilate lungs mouth-to-mouth.

- If ventilation does not occur, place the heel of one hand midline slightly above the navel and below the xiphoid process and place the other hand on top, locking fingers, and quickly thrust upward.

- Repeat up to 5 times and then attempt to sweep mouth and ventilate

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again. Repeat procedures until the foreign body is dislodged or emergency personnel arrive (5 thrusts, finger sweep, ventilation, etc.).

- If the victim begins breathing, place on side in recovery position and remain with the person until emergency personnel arrive.

Chest thrusts: If the victim is markedly obese or pregnant, chest thrusts may be done instead of abdominal thrusts.

The procedures are the same except that the hand is positioned as for cardiac compressions, on the mid sternum above the xiphoid process.

- Compress the chest about 2 inches with each thrust. Chest thrusts can be done with the victim standing, sitting, or supine.
- **NOTE: DO NOT USE with children.** Only abdominal thrusts should be used with infants and children 1 to 8 years.

Children 1-8

For children (1-8), only abdominal thrusts are used. As with adults, the abdominal thrusts can be done with the child standing, sitting, or supine, but an adult rescuer may need to kneel down or hold the child, depending on the child's age and size. The procedure is the same as for adults.

Children may choke on small objects they have placed in their mouths, such as toys or coins, or on foods, such as nuts, which block the airway, so when doing a finger sweep, be careful to sweep side to side but avoid sticking the finger straight in to the back of the child's throat as this may force the object deeper into the throat.

Infants (<1 year)

A different approach is used for infants (<1 year). Indications of choking include lack of

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breathing, gasping, cyanosis, and inability to cry.

- First, position the infant in prone (face down) position along the forearm with the infant's head lower than the trunk, being sure to support the head so the airway is not blocked. The procedure can be done with the rescuer standing or sitting, but with larger infants, the rescuer may be more successful if sitting with the forearm resting on the thigh for support.

- Using the heel of the hand, deliver 5 forceful upward blows between the shoulder blades.

- Sandwich the child between the two arms and turn the infant into supine position and drape over thigh with head lower than trunk and head supported.

- Using two fingers (as for CPR compressions), give up to 5 thrusts (about 1.5 inches deep) to lower third of sternum.

- Do finger sweep and remove foreign object if loose. Attempt to ventilate. Repeat back blows, chest thrusts, and ventilation attempts until foreign body ejected or emergency personnel take over.

- If pulse is absent, begin CPR. If pulse is present but spontaneous respirations are absent, continue ventilation.

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Conclusion

The most important thing to remember about current guidelines for CPR is to begin compressions immediately—hard and fast! The three protocols are:

- C (compressions only)
- CAB (compressions—airway—breathing)
- ABC (airway—breathing—compressions).

Most cardiac arrest victims are adults, so laypersons may use C for adults while trained persons should use CAB. CAB is the standard protocol for infants and children who are less likely to respond to compressions only. ABC is now retained for newborns, drowning victims, and those with drug overdose resulting in respiratory arrest.

The American Heart Association provides a YouTube video that gives an overview of the new guideline and provides demonstrations. Link to site or copy and paste URL into browser: http://www.youtube.com/watch?v=O9T25SMyz3A

Victims of cardiac arrest, even if successfully resuscitated, should be transported to the hospital for advance life support as needed and post-cardiac care.

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