

## BLS for Adults

This section describes BLS for adults. You will learn to perform high-quality CPR skills, both as a single rescuer and as a member of a multirescuer team.

Use adult BLS skills for victims who are adolescents (ie, after the onset of puberty) and older.

### Learning Objectives

In this Part, you will learn to

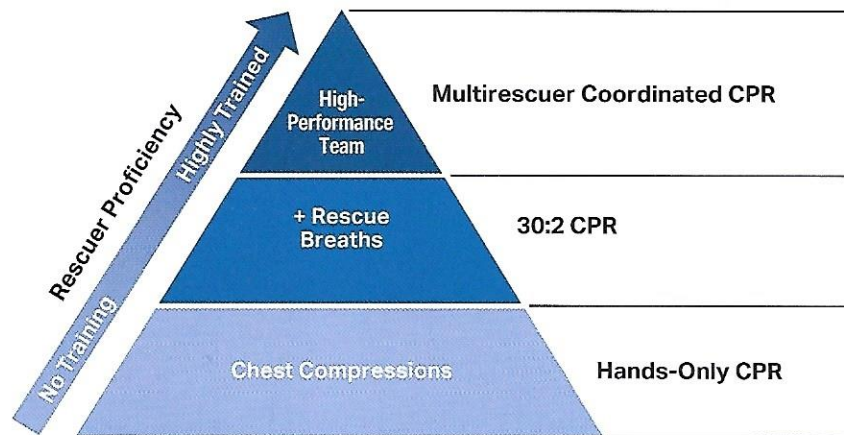
- Recognize the signs of someone needing CPR
- Perform high-quality CPR for an adult
- Provide effective ventilation with a barrier device

### Basic Framework for CPR

Anyone can be a lifesaving rescuer for a cardiac arrest victim (Figure 3). The particular CPR skills a rescuer uses depend on several variables, such as level of training, experience, and confidence (ie, rescuer proficiency). Other variables are the type of victim (child vs adult), available equipment, and other rescuers. A single rescuer with limited training or who has training but limited equipment can do Hands-Only CPR. A rescuer with more training can do 30:2 CPR. When several rescuers are present, they can perform multirescuer-coordinated CPR.

Here are some examples:

- **Hands-Only CPR.** A single rescuer with little training and no equipment who witnesses a cardiac arrest in a middle-aged man might provide only chest compressions until help arrives.
- **30:2 CPR.** A police officer trained in BLS who finds an adolescent in cardiac arrest will provide both chest compressions and breaths by using a ratio of 30 compressions to 2 breaths.
- **High-performance team.** Three emergency responders who are called to assist a woman in cardiac arrest will perform multirescuer-coordinated CPR: rescuer 1 performs chest compressions; rescuer 2 gives breaths with a bag-mask device; rescuer 3 uses the AED. Rescuer 3 also assumes the role of CPR Coach. A CPR Coach helps team members perform high-quality CPR and minimize pauses in chest compressions.

**Figure 3.** Building blocks of CPR.

## High-Performance Rescue Teams

Coordinated efforts by several rescuers during CPR may increase the chances for a successful resuscitation. High-performance teams divide tasks among team members during a resuscitation attempt.

As a team member, you will want to perform high-quality CPR skills to make your maximum contribution to each resuscitation team effort.

See Part 5 for more about team performance.

## Main Components of CPR

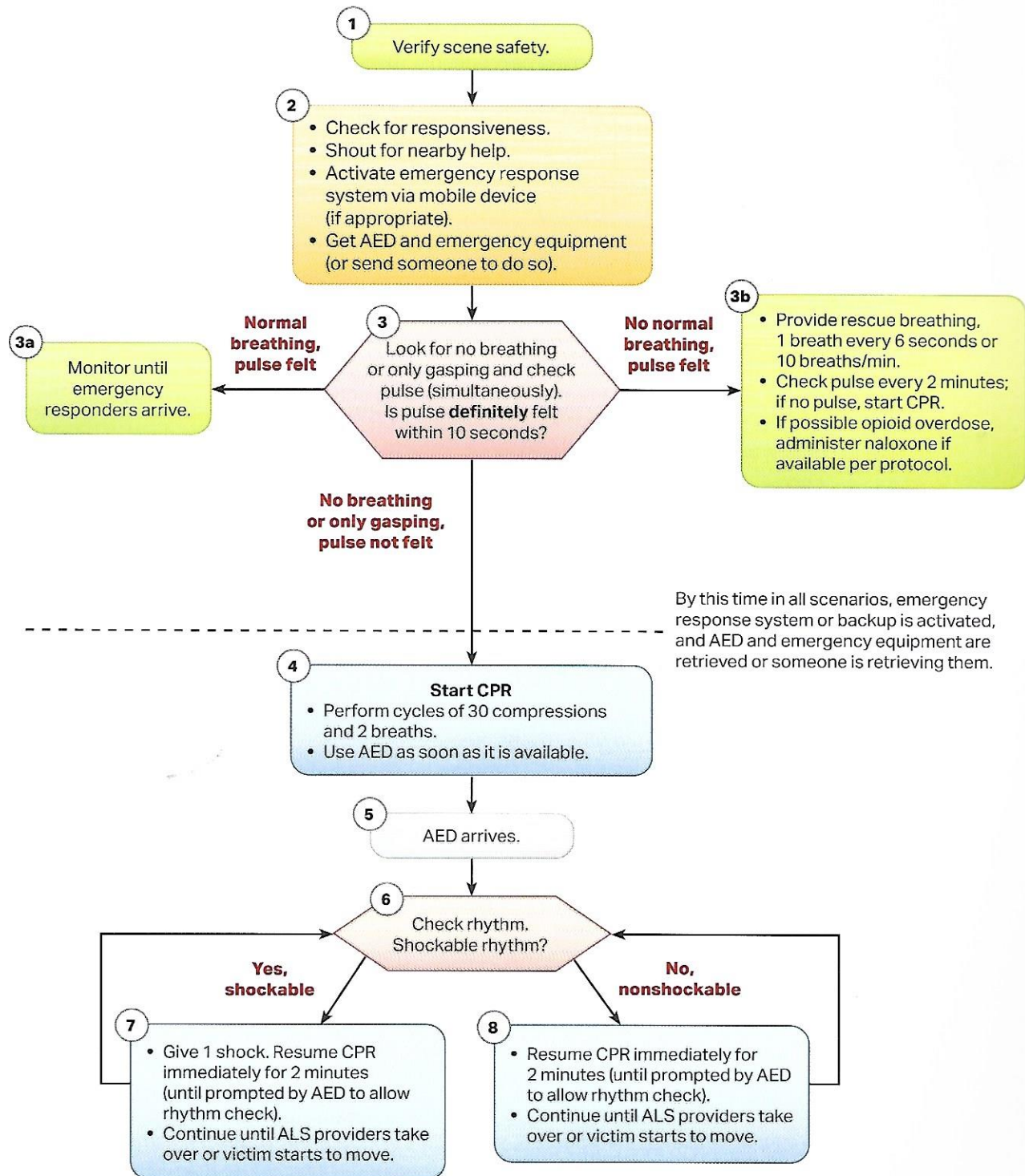
The main components of CPR are

- Chest compressions
- Airway
- Breathing

You will learn about each of these throughout this course.

## Adult BLS Algorithm for Healthcare Providers

The Adult BLS Algorithm for Healthcare Providers outlines steps for single rescuers and multiple rescuers of an unresponsive adult (Figure 4). Once you learn the skills presented in this Part, use this algorithm as a quick reference for providing high-quality CPR to an adult who is in cardiac arrest.

**Figure 4.** Adult BLS Algorithm for Healthcare Providers.

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A rescuer who arrives at the side of a potential cardiac arrest victim should follow these sequential steps on the algorithm:

**Step 1:** Verify scene safety.

Make sure that the scene is safe for you and the victim.

**Step 2:** Check for responsiveness.

Tap the victim's shoulders. Shout, "Are you OK?" If the victim is not responsive, activate the emergency response system via mobile device. Get the AED or send someone to do so.

**Step 3:** Assess for breathing and a pulse.

Check for a pulse to determine next actions. To minimize delay in starting CPR, you should assess breathing and pulse at the same time. This should take no more than 10 seconds.

**Steps 3a and 3b:** Determine next actions based on whether breathing is normal and if a pulse is felt:

- **If the victim is breathing normally and a pulse is felt,** monitor the victim.
- **If the victim is not breathing normally but a pulse is felt:**
  - Provide rescue breathing at a rate of 1 breath every 6 seconds, or 10 breaths per minute.
  - Check for a pulse about every 2 minutes. Perform high-quality CPR if you do not feel a pulse.
  - If you suspect opioid use, give naloxone if available and follow your local protocols.
- **If the victim is not breathing normally or is only gasping and has no pulse,** begin high-quality CPR (Step 4).

**Step 4:** Start high-quality CPR, with 30 chest compressions followed by 2 breaths. Use an AED as soon as it is available.

**Steps 5 and 6:** Use the AED as soon as it is available. Follow the AED directions to check the rhythm.

**Step 7:** If the AED detects a shockable rhythm, give 1 shock. Resume CPR immediately until prompted by the AED to allow a rhythm check, about every 2 minutes. Continue CPR and using the AED until advanced life support providers take over or the victim begins to breathe, move, or otherwise react.

**Step 8:** If the AED detects a nonshockable rhythm, resume high-quality CPR until prompted by the AED to allow a rhythm check, about every 2 minutes. Continue CPR and using the AED until advanced life support providers take over or the victim begins to breathe, move, or otherwise react.

For a complete explanation of each step, see the Adult 1-Rescuer BLS Sequence in the Appendix.

## High-Quality CPR Skills: Adults

Learning the skills in this section will prepare you to provide high-quality CPR to adults.

### Assess for Breathing and a Pulse

Assess the victim for normal breathing and a pulse (Figure 5). This will help you determine the next appropriate actions.

*To minimize delay in starting CPR, you should assess breathing at the same time as you check the pulse. This should take at least 5 seconds but no more than 10 seconds.*

### Breathing

To check for breathing, scan the victim's chest for rise and fall *for no more than 10 seconds*.

- **If the victim is breathing:** Monitor the victim until additional help arrives.
- **If the victim is not breathing or is only gasping:** Be prepared to begin high-quality CPR. Gasping is not normal breathing and is a sign of cardiac arrest.



### **Critical Concepts: Agonal Gasps**

*Agonal gasps may be present in the first minutes after sudden cardiac arrest. Agonal gasps are not normal breathing.*

*A person who gasps usually appears to be drawing air in very quickly. The mouth may be open, and the jaw, head, or neck may move with gasps. Gasps may appear forceful or weak. Some time may pass between gasps because they usually happen at a slow, irregular rate. The gasp may sound like a snort, snore, or groan.*

*Gasping is not normal breathing. It is a sign of cardiac arrest.*

### **Checking for the Carotid Pulse on an Adult**

To perform a pulse check on an adult, feel for a carotid pulse (Figure 5).

*If you do not definitely feel a pulse within 10 seconds, begin high-quality CPR, starting with chest compressions.*

**Figure 5.** Check for breathing and a pulse at the same time.

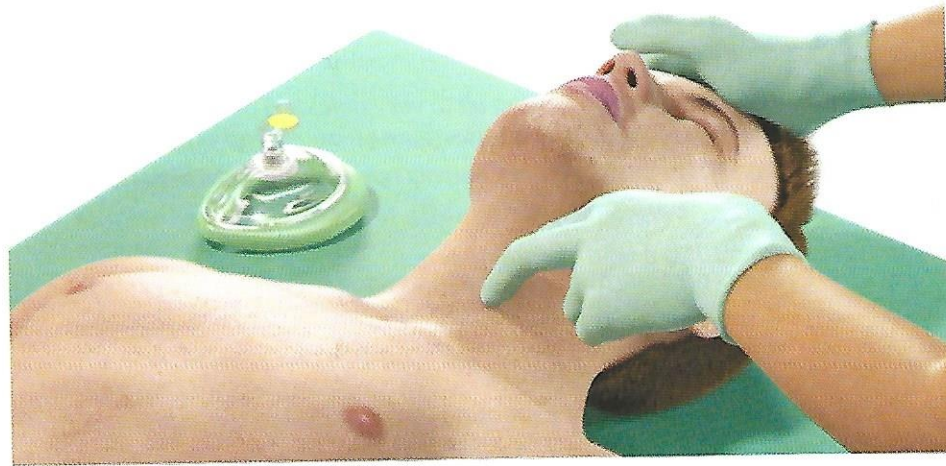


Follow these steps to find and feel for the carotid pulse:

- Locate the trachea (on the side closest to you), using 2 or 3 fingers (Figure 6A).
- Slide those fingers into the groove between the trachea and the muscles at the side of the neck, where you can feel the carotid pulse (Figure 6B).
- Feel for a pulse *for at least 5 but no more than 10 seconds*. If you do not definitely feel a pulse, begin CPR, starting with chest compressions.

**Figure 6.** Finding the carotid pulse. **A.** Locate the trachea. **B.** Gently feel for the carotid pulse.

**A**



**B**



In all scenarios, by the time a breathing-and-pulse check indicates cardiac arrest, the following should already be happening:

- Someone has activated the emergency response system.
- Someone has gone to get the AED.

## Perform High-Quality Chest Compressions

The foundation of CPR is high-quality chest compressions. Compressing the chest during CPR pumps blood from the heart to the brain and then to the rest of the body. Each time you stop chest compressions, the blood flow from the heart to the brain and other organs decreases significantly. Once you resume compressions, it takes several compressions to bring the blood flow back up to the levels present before the interruption. Thus, the more often you interrupt chest compressions and the longer the interruptions are, the lower the blood supply to the brain and critical organs.

When a victim is not breathing normally or is only gasping and has no pulse, begin CPR, starting with chest compressions.

### Position Victim

Position the victim faceup on a firm, flat surface, such as the floor or a backboard. This will help ensure that the chest compressions are as effective as possible. If the victim is on a soft surface, such as a mattress, the force from the chest compressions will simply push the victim's body into the soft surface. A firm surface allows compression of the chest and the heart to create adequate blood flow.

### Compression-to-Ventilation Ratio

Single rescuers should use the compression-to-ventilation ratio of 30 compressions to 2 breaths when giving CPR to victims of any age.

### Compression Rate

Compress at a rate of 100 to 120/min. This rate is the same for compressions in all cardiac arrest victims.

### Compression Depth

Compress the chest at least 2 inches (5 cm). As you practice this skill, remember that chest compressions are more often too shallow than too deep. However, it is possible to compress too deeply. Compressing the chest more than 2.4 inches (6 cm) in adults may decrease effectiveness of the compression and cause injuries. Using a CPR-quality feedback device can help you reach the optimal compression depth of 2 to 2.4 inches (5 to 6 cm).

### Chest Recoil

Allow the chest to recoil (reexpand) completely after each compression. *Chest recoil* (reexpansion of the chest) allows blood to flow into the heart. Incomplete chest recoil reduces the filling of the heart between compressions and reduces the blood flow created by chest compressions. To help ensure complete recoil, avoid leaning on the chest between compressions. Chest compression and chest recoil times should be about equal.

### Interruptions in Chest Compressions

Minimize interruptions in chest compressions. Shorter duration of interruptions in chest compressions is associated with better outcome. The proportion of time that rescuers perform chest compressions during CPR is called *chest compression fraction* (CCF). A CCF of at least 60% increases the likelihood of ROSC, shock success, and survival to hospital discharge. With good teamwork and training, rescuers can often achieve 80% or greater. This should be the goal in all team resuscitation events.

Do not move the victim while CPR is in progress unless the victim is in a dangerous environment (such as a burning building) or you believe you cannot perform CPR effectively under the current circumstances.

When help arrives, the resuscitation team, because of local protocol, may choose to continue CPR at the scene or transport the victim to an appropriate facility while continuing rescue efforts. High-quality BLS is key at all times during the resuscitation event.

## Chest Compression Technique

Follow these steps to perform chest compressions on an adult:

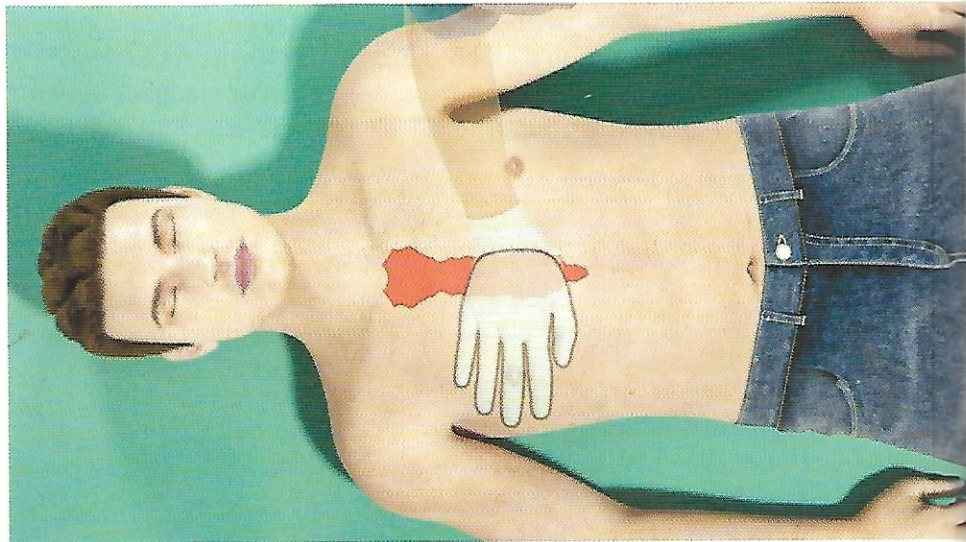
1. Position yourself at the victim's side.
  - a. Make sure the victim is lying faceup on a firm, flat surface. If the victim is facedown, carefully roll the person over. If you suspect a head or neck injury, try to keep the

head, neck, and torso in a line when rolling the victim to a faceup position. If someone can assist you in rolling the victim.

2. Position your hands and body to perform chest compressions:
  - a. Place the heel of one hand in the center of the victim's chest, on the lower half of the breastbone (sternum) (Figure 7A).
  - b. Put the heel of your other hand on top of the first hand.
  - c. Straighten your arms and position your shoulders directly over your hands.
3. Give chest compressions at a rate of 100 to 120/min.
4. Press down at least 2 inches (5 cm) with each compression; this requires hard work. For each chest compression, make sure you push straight down on the victim's breastbone (Figure 7B).
5. At the end of each compression, always allow the chest to recoil completely. Avoid leaning on the chest between compressions.
6. Minimize interruptions of chest compressions. (You will learn to combine compressions with ventilation next.)

**Figure 7. A,** Place the heel of your hand on the breastbone, in the center of the chest. **B,** Correct position the rescuer during chest compressions.

**A**



**B**





## Alternate Technique for Chest Compressions

If you have difficulty pushing deeply during compressions, do the following:

- Put one hand on the breastbone to push on the chest.
- Grasp the wrist of that hand with your other hand to support the first hand as you push down on the chest (Figure 8).

This technique may be helpful for rescuers with joint conditions, such as arthritis.

**Figure 8.** Alternate technique for giving chest compressions to an adult.



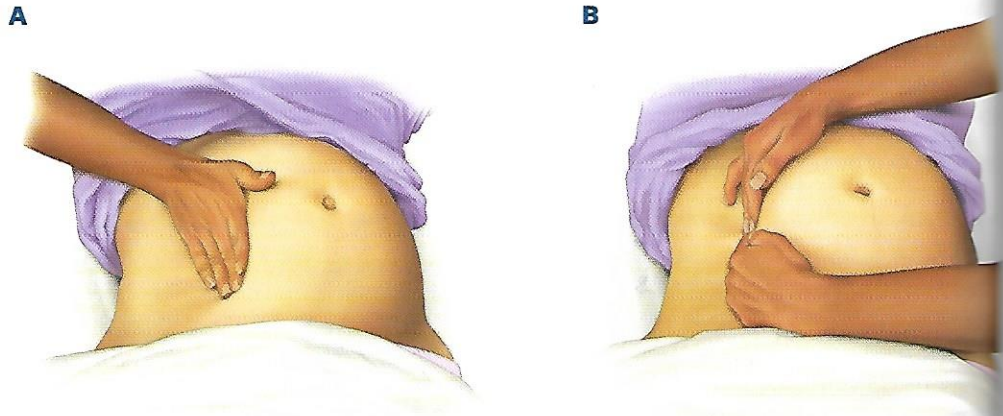
## Compressions for a Pregnant Woman

Do not delay providing chest compressions for a pregnant woman in cardiac arrest. High-quality CPR, including respiratory support and early medical intervention, can increase the mother's and the infant's chance of survival. If you do not perform CPR on a pregnant woman when needed, the lives of both the mother and the infant are at risk. Perform high-quality chest compressions and ventilation for a pregnant woman just as you would for any victim of cardiac arrest. For more information, see Figure 44 and sequence in the Appendix.

Be aware that when a visibly pregnant woman (approximately 20 weeks) is lying flat on her back, the uterus compresses the large blood vessels in the abdomen. This pressure can interfere with blood flow to the heart generated by the chest compressions. Manual lateral uterine displacement (LUD) (ie, manually moving the uterus to the patient's left to relieve the pressure on the large blood vessels) can help relieve this pressure.

If additional rescuers are present and rescuers are trained, perform continuous LUD in addition to high-quality BLS (Figure 9). If the woman is revived, place her on her left side. This may help improve blood flow to her heart and, therefore, to the baby.

**Figure 9.** Manual LUD during CPR. **A**, 1-handed technique. **B**, 2-handed technique.



### **Critical Concepts:** **Perform High-Quality Chest Compressions**

- Use a ratio of 30 compressions to 2 breaths.
- Compress at a rate of 100 to 120/min, with a depth of at least 2 inches (5 cm) for adults.
- Allow complete chest recoil after each compression. Do not lean on the chest between compressions.
- Minimize interruptions in chest compressions. Try to limit pauses in compressions to less than 10 seconds. The goal is a CCF of at least 60%; with good teamwork, rescuers can often achieve 80% or higher.

## Give Breaths

### Opening the Airway

For breaths to be effective, the victim's airway must be open. Two methods for opening the airway are

- Head tilt–chin lift
- Jaw thrust

Important: If you suspect a head or neck injury, use the jaw-thrust maneuver to reduce head and spine movement. If the jaw thrust does not open the airway, use the head tilt–chin lift maneuver.

When multiple rescuers are available, one rescuer can perform a jaw thrust while another rescuer provides breaths with a bag-mask device. The third rescuer will give chest compressions.

### Head Tilt–Chin Lift

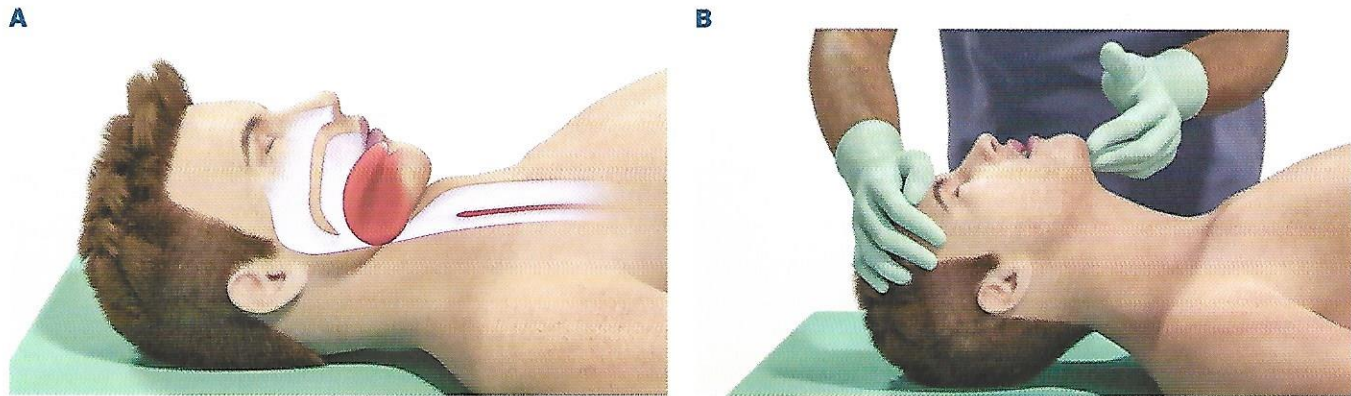
Follow these steps to perform a head tilt–chin lift (Figure 10):

1. Place one hand on the victim's forehead and push with your palm to tilt the head back.
2. Place the fingers of the other hand under the bony part of the lower jaw, near the ear.
3. Lift the jaw to bring the chin forward.

When performing a head tilt–chin lift, make certain that you

- Avoid pressing deeply into the soft tissue under the chin because this might block the airway
- Do not close the victim's mouth completely

**Figure 10.** The head tilt–chin lift maneuver. **A**, Obstruction by the tongue. When a victim is unresponsive, the tongue can block the upper airway. **B**, The head tilt–chin lift maneuver lifts the tongue, relieving the airway obstruction.



## Jaw Thrust

When the head tilt–chin lift doesn't work or when you suspect a spinal injury, use the jaw-thrust maneuver (Figure 11).

Follow these steps to perform a jaw thrust:

1. Position yourself at the victim's head.
2. Place one hand on each side of the victim's head. You may rest your elbows on the surface where the victim is lying.
3. Place your fingers under the angle of the victim's lower jaw and lift with both hands, displacing the jaw forward (Figure 11).
4. If the victim's lips close, push the lower lip with your thumbs to open the lips.

If the jaw thrust does not open the airway, use a head tilt–chin lift.

**Figure 11.** Jaw thrust.



## Barrier Devices for Giving Breaths

When giving breaths during CPR, standard precaution is to use a barrier device. Examples are pocket masks (preferred) and face shields. Rescuers should replace face shields with a pocket mask at the first opportunity.

Infection from CPR is extremely unlikely. Only a few cases have been reported. Yet, the US Occupational Safety and Health Administration requires that healthcare workers use standard precautions when performing CPR in the workplace.

## Pocket Masks

For mouth-to-mask breaths, use a pocket mask (Figure 12). Pocket masks usually have a 1-way valve that diverts exhaled air, blood, or bodily fluids away from the rescuer. The 1-way valve allows the rescuer's breath to enter the victim's mouth and nose and diverts the victim's exhaled air away from the rescuer.

Pocket masks are available in different sizes for adults, children, and infants (Figure 12). Effective use of the pocket mask barrier device requires instruction and practice.

**Figure 12.** Adult, child, and infant pocket masks.

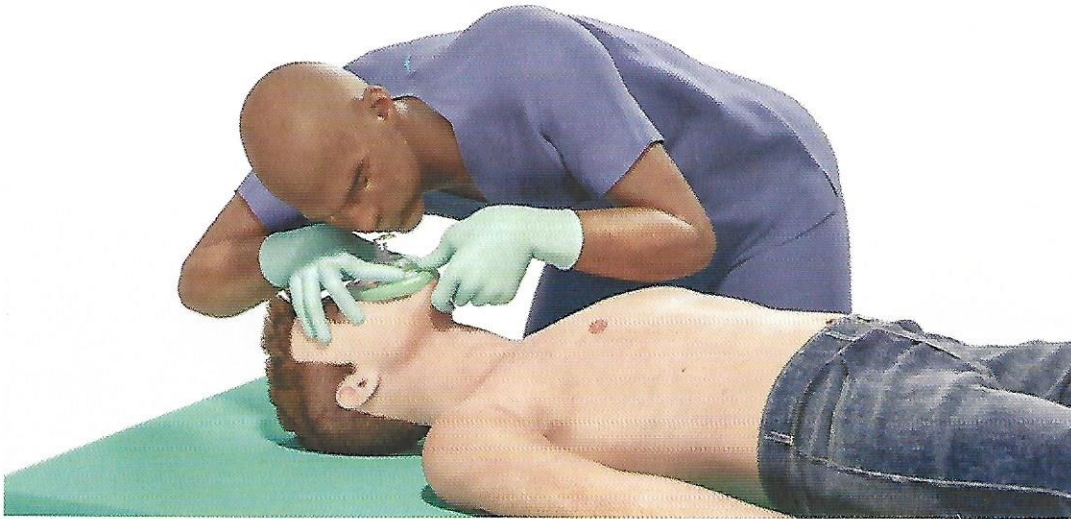


To use a pocket mask, position yourself at the victim's side. This position is ideal for 1-rescuer CPR because you can give breaths and perform chest compressions without repositioning yourself every time you change from compressions to giving breaths.

Follow these steps to open the airway with a head tilt–chin lift and give breaths with a pocket mask:

1. Position yourself at the victim's side.
2. Place the pocket mask on the victim's face, using the bridge of the nose as a guide for correct positioning.
3. Seal the pocket mask against the face.
  - a. Using your hand that is closer to the top of the victim's head, place your index and thumb along the top edge of the mask.
  - b. Place the thumb of your other hand along the bottom edge of the mask.
  - c. Place the remaining fingers of your second hand along the bony margin of the jaw and lift the jaw. Perform a head tilt–chin lift to open the airway (Figure 10).
  - d. While you lift the jaw, press firmly and completely around the outside edge of the mask to seal the pocket mask against the face (Figure 13).
4. Deliver each breath over 1 second, enough to make the victim's chest rise.

**Figure 13.** Press firmly and completely around the outside edge of the mask to seal the pocket mask against the face.



### **Critical Concepts: Adult Breaths**

Remember: When interrupting chest compressions to give 2 breaths with a barrier device, be sure that you

- Deliver each breath over 1 second
- Note visible chest rise with each breath
- Resume chest compressions in less than 10 seconds

### **Oxygen Content of Exhaled Air**

The air we breathe in contains about 21% oxygen. The air we breathe out contains about 17% oxygen. This means that the air a rescuer breathes out still contains plenty of oxygen to provide the victim with much-needed oxygen.

## **Bag-Mask Devices**

Use a bag-mask device, if available, (Figure 14) to provide positive-pressure ventilation to a victim who is either not breathing or not breathing normally. The device consists of a bag attached to a face mask. If the bag is self-inflating, you may use it with or without an oxygen supply. If not attached to oxygen flow, it provides about 21% oxygen from room air. Some bag-mask devices include a 1-way valve. The type of valve may vary from one device to another.

Face masks are available in a variety of sizes. Common sizes are infant (small), child (medium), and adult (large). For a proper fit, the mask should

- Extend from the bridge of the nose to just above the lower edge of the chin
- Cover the nose and mouth; make sure the mask does not apply pressure to the eyes (Figure 15)

The flexible, cushioned mask should provide an airtight seal. If the seal is not airtight, ventilation will be ineffective.

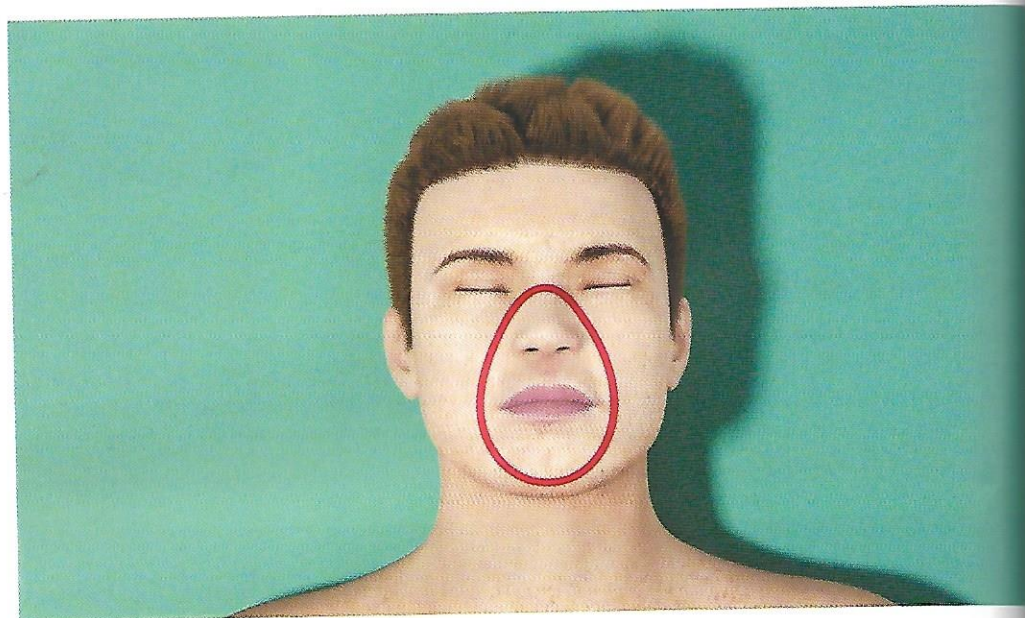
Bag-mask ventilation during CPR is more effective when 2 rescuers provide it together. One rescuer opens the airway and seals the mask against the face while the other squeezes the bag.

All BLS providers should be able to use a bag-mask device. Proficiency in this ventilation technique requires practice.

**Figure 14.** Bag-mask device.



**Figure 15.** Proper area of the face for face mask application. Note that the mask should not apply pressure to the eyes.



### Bag-Mask Ventilation Technique (1 Rescuer)

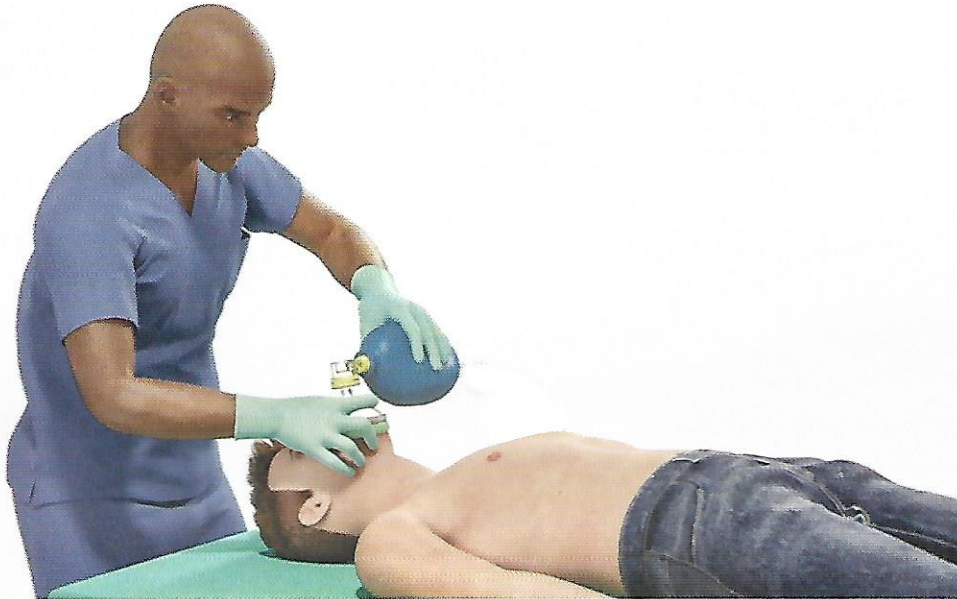
To open the airway with a head tilt–chin lift and use a bag-mask device to give breaths to a victim, follow these steps:

1. Position yourself directly above the victim's head.
2. Place the mask on the victim's face, using the bridge of the nose as a guide for correct positioning. Use the E-C clamp technique to hold the mask in place while you lift the jaw to hold the airway open (Figure 16).
  - a. Perform a head tilt.
  - b. Place the mask on the face with the narrow portion at the bridge of the nose.

- c. Use the thumb and index finger of one hand to make a "C" on the side of the mask, pressing the edges of the mask to the face.
  - d. Use the remaining fingers to lift the angles of the jaw (3 fingers form an "E"). Open the airway, and press the face to the mask.
3. Squeeze the bag to give breaths while watching for chest rise. Deliver each breath over 1 second, with or without the use of supplemental oxygen.

**Figure 16.** E-C clamp technique of holding the mask while lifting the jaw. **A**, Side view. **B**, Aerial view.

**A**



**B**

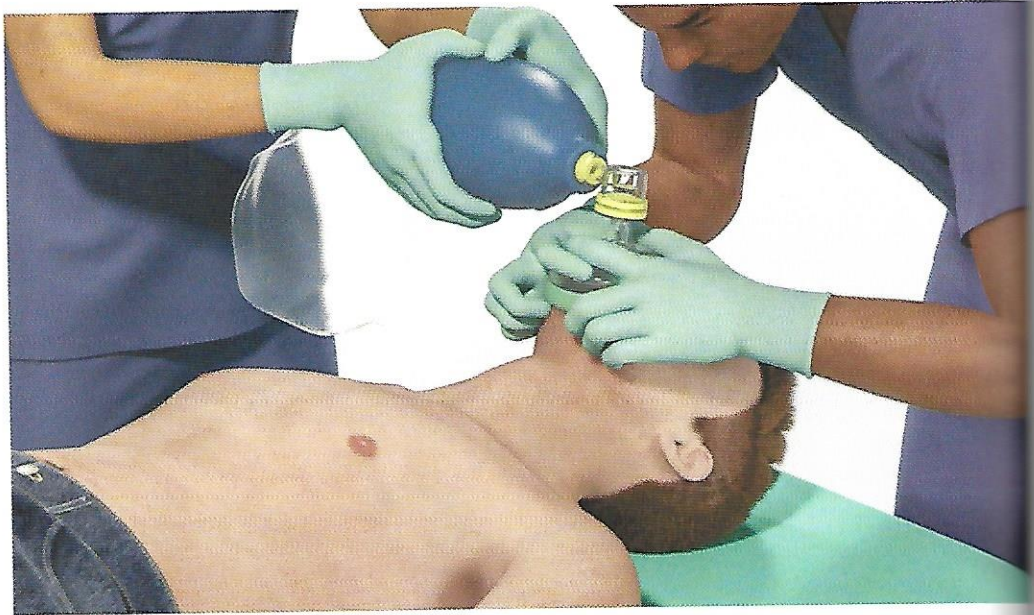


### Bag-Mask Ventilation Technique (2 or More Rescuers)

When 3 or more rescuers are present, 2 of them working together can provide more effective and efficient bag-mask ventilation than 1 rescuer can. Two rescuers work together in this way (Figure 17):

1. Rescuer 1, positioned directly above the victim, opens the airway and positions the bag-mask device, following the steps described in the Bag-Mask Ventilation Technique (1 Rescuer) section.
  - a. This rescuer should be careful not to press too hard on the mask, because doing so could push the patient's jaw down and block the airway.
2. Rescuer 2, positioned at the victim's side, squeezes the bag.

**Figure 17.** Two-rescuer bag-mask ventilation.



### Ventilation for a Victim With a Stoma or Tracheostomy Tube

When ventilating a victim who has a stoma or tracheostomy tube, position the mask over the stoma or tube and use the previously described techniques. A pediatric mask may be more effective than an adult mask. If the chest doesn't rise, you may connect the bag-mask device directly to the tracheostomy tube. If the chest still does not rise, you may need to close the victim's mouth while providing breaths over the stoma or tracheostomy tube.



#### **Critical Concepts:** **Two Rescuers for Jaw Thrust and Bag-Mask Ventilation**

*During CPR, jaw thrust and bag-mask ventilation are more efficiently performed when two more rescuers are providing ventilation. One rescuer must be positioned above the victim's head and use both hands to open the airway, lift the jaw, and hold the mask to the face. The second rescuer squeezes the bag. The second rescuer is positioned at the victim's side.*

## Adult 2-Rescuer BLS

When you encounter an unresponsive adult and other rescuers are available, work together to follow the steps outlined in the Adult BLS Algorithm for Healthcare Providers (Figure 17-1). When more rescuers are available for a resuscitation attempt, more tasks can be performed at the same time.



The first rescuer who arrives at the side of a potential cardiac arrest victim should quickly assess the scene for safety and check the victim for responsiveness. This rescuer should send another rescuer to activate the emergency response system and get the AED. As more rescuers arrive, assign tasks. Additional rescuers can help with bag-mask ventilation, compressions, and using the AED (Figure 18).

For complete step-by-step instructions on following the Adult BLS Algorithm for Healthcare Providers as part of a multi-rescuer team, see the Adult 2-Rescuer BLS Sequence in the Appendix.

**Figure 18.** Multiple rescuers can perform simultaneous tasks during a resuscitation attempt.



### Team Roles and Duties for 2 or More Rescuers

When more rescuers are available for a resuscitation attempt, they can perform more tasks at the same time. In two-rescuer CPR (Figure 19), each rescuer has specific tasks.

#### **Rescuer 1: Provide Compressions**

Position yourself at the victim's side.

- Make sure the victim is faceup on a firm, flat surface.
- Perform chest compressions.
  - Compress at a rate of 100 to 120/min.
  - Compress the chest at least 2 inches (5 cm) for adults.
  - Allow the chest to recoil completely after each compression; avoid leaning on the victim's chest between compressions.
  - Minimize interruptions in compressions (try to limit any interruptions in chest compressions to less than 10 seconds).
  - Use a compression-to-ventilation ratio of 30:2.
  - Count compressions out loud.
- Switch compressors about every 5 cycles or every 2 minutes (more frequently if fatigued). Take less than 5 seconds to switch.