

CPR and AED



**AMERICAN
SAFETY &
HEALTH
INSTITUTE**

AMERICAN SAFETY & HEALTH INSTITUTE

CPR and AED Student Book, *Version 8.0*

Purpose of this Student Book

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Cardiac Arrest



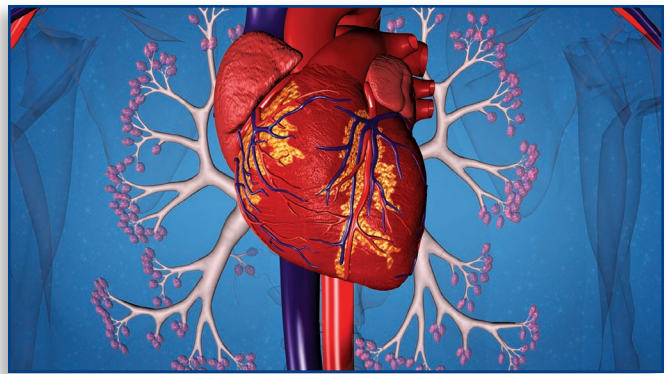
Because the human body cannot store oxygen, it must continually supply tissues and cells with oxygen through the combined actions of the respiratory and circulatory systems.

Oxygen and the Human Body

The respiratory system includes the lungs and the airway, the passage from the mouth and nose to the lungs. Expansion of the chest during breathing causes suction, which pulls outside air containing oxygen through the airway and into the lungs. Relaxation of the chest increases the pressure within and forces used air to be exhaled from the lungs.

The circulatory system includes the heart and a body-wide network of blood vessels. Electrical impulses stimulate contractions of the heart to create pressure that pushes blood throughout the body. Blood vessels in the lungs absorb oxygen from inhaled air. The oxygen-rich blood goes to the heart, then out to the rest of the body.

Large vessels called arteries carry oxygenated blood away from the heart. Arteries branch down into very small vessels that allow oxygen to be absorbed directly into body cells so it can be used for energy production. Veins return oxygen-poor blood back to the heart and lungs, where the cycle repeats.



The brain is especially sensitive to a lack of oxygen. When oxygen is cut off, brain cell damage and death can occur within a matter of minutes.

Sudden Cardiac Arrest (SCA)

Cardiac arrest is the loss of the heart's ability to pump blood to the body. The most dramatic occurrence, sudden cardiac arrest, can happen with little or no warning. Victims abruptly become unresponsive and collapse. Abnormal gasping can occur. Breathing may stop completely.

The most likely cause of sudden cardiac arrest is an unexpected disruption to the heart's electrical system, in which normally organized electrical pulses within the heart become disorganized and a chaotic quivering condition known as ventricular fibrillation occurs. Blood flow to the body, along with the oxygen it carries, stops. Without blood flow, brain damage occurs rapidly and quickly leads to death.

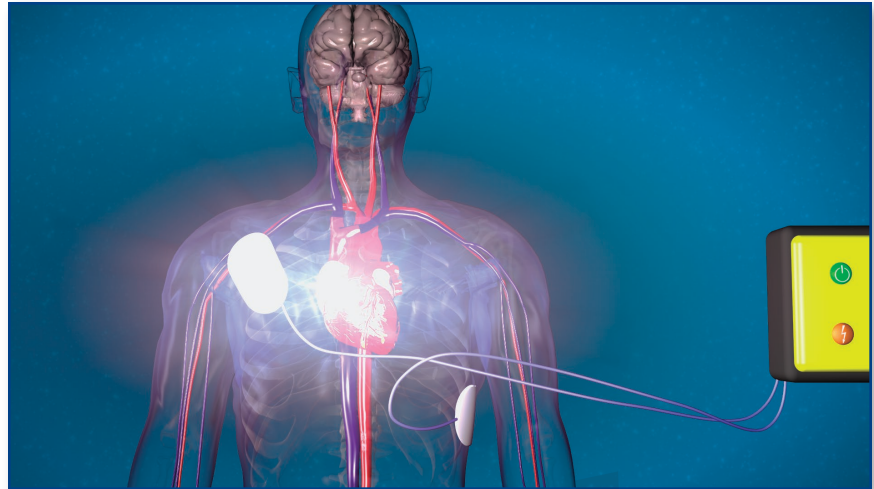
Cardiopulmonary Resuscitation (CPR)

Cardiopulmonary resuscitation (CPR) is the immediate treatment for a suspected cardiac arrest. CPR allows a bystander to restore limited oxygen to the brain through a combination of chest compressions and rescue breaths. However, CPR alone is not enough.

Early Defibrillation

The most effective way to end fibrillation is defibrillation, using a defibrillator and electrode pads applied to the chest. A controlled electrical shock is sent through the heart to stop ventricular fibrillation, allowing the heart's normal electrical activity to return and restore blood flow.

Successful defibrillation is highly dependent on how quickly defibrillation occurs. For each minute in cardiac arrest, the chance of survival goes down by about 10%. After as few as 10 minutes, survival is unlikely.



Simply activating EMS will not help. Even in the best EMS systems, the amount of time it takes from recognition of the arrest to EMS arriving at the side of the injured or ill person is usually longer than 10 minutes.

An automated external defibrillator (AED) is a small, portable, computerized device that is simple for anyone to operate. Bystander use of AEDs has been growing steadily, with common placements of the devices in public locations such as airports and hotels, and workplaces in general.

Turning on an AED is as simple as opening a lid or pushing a power button. Once it is on, an AED provides voice instructions to guide you through its attachment and use.

An AED automatically analyzes the heart rhythm, determines if a shock is needed, and charges itself to be ready to defibrillate. An operator simply pushes a button to deliver the shock when prompted by the AED.

Chain of Survival

Sudden cardiac arrest can strike at any age, but primarily affects adults. The chain of survival is often used to describe the best approach for treating sudden cardiac arrest. Each link in the chain is essential for a person to survive. If a single link is weak or missing, the chances for survival are greatly reduced. The greatest chance for survival exists when all the links are strong:

- Early recognition of cardiac arrest and activation of EMS
- Immediate CPR with high-quality chest compressions
- Rapid defibrillation, or electrical shock, to the heart
- Effective basic and advanced EMS care and transport
- Effective post-cardiac arrest care at a hospital



Secondary Cardiac Arrest

Unlike sudden cardiac arrest, in which the heart is the primary problem, cardiac arrest can also be the end result of the loss of an airway or breathing. This is secondary cardiac arrest.

Problems such as hazardous breathing conditions in a confined space, drowning, and drug overdoses can result in secondary cardiac arrest. With no incoming oxygen, the heart progressively becomes weaker until signs of life become difficult or impossible to assess.

If the heart is simply too weak to create obvious signs of life, immediate CPR, with an emphasis on effective rescue breaths, may be the only chance to restore them.



Opioid Overdose

The abuse of opioid drugs to get a euphoric high is a serious and growing health problem. Increasing prescriptions for opioid pain relievers, such as hydrocodone and oxycodone, have made them more commonly available. The use of heroin, a highly addictive opioid, also contributes to the problem.



As a result, the number of overdoses and deaths from prescription opioids and heroin has increased dramatically. Opioids, taken in excess, can depress and stop breathing. Opioid overdose is a clear cause of secondary cardiac arrest.

Naloxone, also known as Narcan, is a medication that can temporarily reverse the life-threatening effects of opioids. It is easy to administer, either through an auto-injector device or through an aerosol that is sprayed into the nose. Naloxone is becoming more readily available to lay providers.

It is reasonable to provide education and training on responding to suspected opioid overdoses, including the administration of naloxone, to those most likely to be involved with this type of emergency. Laws regarding first aid administration of naloxone vary by city and state. As with Good Samaritan laws, know the laws in your area.

Children and Infants

Children are more likely to experience secondary cardiac arrest instead of a primary one. This is an important consideration in how you approach a child or infant you think may have arrested.

When describing age groups in relation to CPR, an infant is younger than 1 year of age. A child is 1 year of age until the onset of puberty. Puberty can be estimated by breast development in females and the presence of armpit hair in males. An adult is from the onset of puberty and older.

The chain of survival for children and infants includes the following links:

- Prevention of airway and breathing emergencies
- Early CPR, with an emphasis on effective rescue breaths, and, if needed, defibrillation with an AED
- Prompt activation of EMS
- Effective basic and advanced EMS care and transport
- Effective post-cardiac arrest care at a hospital



Knowledge Check

The chain of survival is often used to describe the best approach for treating sudden cardiac arrest. The first three links of the chain are typically the responsibility of a trained CPR provider. Describe those links.

Chest Compressions

External compression of the chest increases pressure inside the chest and directly compresses the heart, forcing blood to move from the chest to the lungs, brain, and the rest of the body.

Quality matters. The better you compress, the greater the influence on survival. Focus on high-quality techniques:

- Compress deeply, more than 2 inches. It is likely you will not compress deep enough. While injury could occur from deeper compressions, do not let the fear of this affect compression depth.
- Compress fast, between 100 and 120 times per minute. Do not let a higher compression speed result in shallower compression depth.
- Allow the chest wall to fully recoil, or rebound, between compressions. Avoid leaning on the chest at the top of each compression.

When compressing properly, you may hear and feel changes in the chest wall. This is normal. Forceful external chest compressions may cause chest injury, but are critical if the person is to survive. Reassess your hand positioning and continue compressions.



Children and Infants

The compression technique for children is similar to that of adults. You can use the heel of one hand on the lower half of the breastbone to compress the chest of a child. If this is difficult, or you are getting tired, use two hands to perform compressions.

Use the tips of two fingers on the breastbone, just below the nipple line, to compress the chest of an infant.



Knowledge Check

What are the 3 measures of high-quality chest compressions for an adult?

Chest Compressions — Adults



Position Your Hands

- Position person face up on a firm, flat surface. Kneel close to chest.
- Place heel of one hand on center of chest, on lower half of breastbone.
- Place heel of your other hand on top of and parallel to first. You can interlace your fingers to keep them off chest.



Position Your Body

- Bring your body up and over chest so your shoulders are directly above your hands. Straighten your arms and lock your elbows.



Compress

- Bending at the waist, use upper body weight to push straight down at least 2 inches.
- Lift hands and allow chest to fully return to its normal position. Move immediately into downstroke of next compression.
- Avoid leaning on chest at the top of each compression.
- Continue compressions at a rate of 100–120 times per minute.

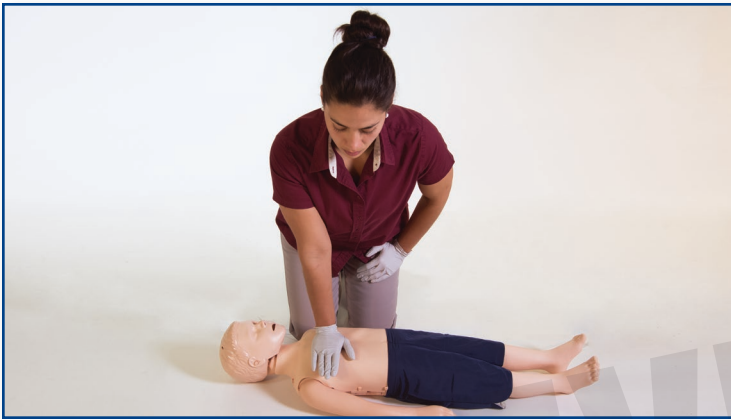
Chest Compressions — Children and Infants



Child

Positioning

- Position child face up on a firm, flat surface. Kneel close to chest.
- Place heel of one hand on lower half of breastbone, just above point where ribs meet. Use both hands if needed.
- Bring your body up and over chest so your shoulders are directly above your hand. Straighten your arm and lock your elbow.



Compress

- Bending at waist, use upper body weight to push straight down $\frac{1}{3}$ depth of chest, or about 2 inches.
- Lift your hand and allow chest to return fully to its normal position. Move immediately into downstroke of next compression.
- Avoid leaning on chest at top of each compression.
- Continue compressions at a rate of 100–120 times per minute.



Infant

Positioning

- Position infant face up on a firm, flat surface.
- Place 2 fingertips on breastbone just below nipple line.



Compress

- Compress at least $\frac{1}{3}$ depth of chest, or about $1\frac{1}{2}$ inches.
- Lift fingers and allow chest to return fully to its normal position. Move immediately into downstroke of next compression.
- Continue compressions at a rate of 100–120 times per minute.

Primary Assessment — Unresponsive Person



The primary assessment is a simple way to quickly identify if a life-threatening condition is present. It is the initial approach to anyone suspected of being ill or injured.

The steps of the primary assessment are always the same:

- If it is safe to provide care, check for responsiveness.
- If unresponsive, activate EMS and get an AED, if one is available.
- Check for normal breathing.

If you determine a person is unresponsive, send a bystander to activate EMS and get an AED. If you are alone, do this yourself and quickly return to the person.

When alone with an unresponsive child or infant, provide about 2 minutes of CPR before leaving to call for EMS and get an AED.

If you have a mobile phone, use it to activate EMS. The speaker function will allow you to follow instructions from an EMS dispatcher while providing care.

To check for normal breathing, quickly look at the face and chest. Take no longer than 10 seconds. Normal breathing is effortless, quiet, and regular. If you are unsure, assume breathing is not normal.

Weak, irregular gasping, snorting, or gurgling sounds can occur early in cardiac arrest. These actions provide no usable oxygen. This is not normal breathing.

If the person is not breathing, or only gasping, perform CPR, beginning with compressions.

When an unresponsive person is breathing normally, and uninjured, place him or her in a side-lying recovery position to help protect the airway.

Recovery Position

The recovery position helps protect the airway by using gravity to drain fluids from the mouth and keep the tongue from blocking the airway.

Frequently assess the breathing of anyone placed in the recovery position. The person's condition could quickly become worse and require additional care.

When a head, neck, or back injury is suspected, it is best to leave the person in the position found. However, if the airway is threatened, quickly roll the person as needed to clear and protect it. Keep the head, shoulders, and torso from twisting as best you can.

Always perform a primary assessment anytime you suspect someone is ill or has been injured to quickly determine the need for CPR.



Knowledge Check

A fellow employee collapses near you during a staff meeting. As a trained CPR provider, you move to help. You kneel next to him, squeeze his shoulder, and loudly ask, "Are you all right?" He is unresponsive, so you direct other employees to activate EMS and get the company's AED. You look closely at the face and chest for breathing; he makes a brief gasping snort, but then remains still. What do you do next?

PREVIEW

Primary Assessment — Unresponsive Person



Assess Scene

- Pause and assess scene for safety.
- If unsafe, or if it becomes unsafe at any time, GET OUT!



Check for Response

- Tap or squeeze shoulder and ask loudly, “Are you all right?”
- If unresponsive, have someone activate EMS and get an AED.



Look for Normal Breathing

- Position person face-up on a firm, flat surface.
- Look at face and chest for normal breathing. Take no longer than 10 seconds. If unsure, assume breathing is not normal.
- Weak, irregular gasping, snorting, or gurgling is not normal breathing.



Provide Indicated Care

- If person is not breathing, or only gasping, perform CPR, beginning with compressions.
- If normal breathing is found, place an uninjured person in recovery position.

Choking



Choking can occur when a solid object, such as a piece of food, or a small object, enters a narrowed part of the airway and becomes stuck. On inhalation, the object can be drawn tighter into the airway and block air from entering the lungs.

A forceful thrust beneath the ribs and up into the diaphragm can pressurize the air in the chest and pop an obstruction out of the airway. Compression of the chest over the breastbone can also create enough pressure to expel an object.

Mild Obstruction

To provide the appropriate care, you must first be able to recognize the difference between a mild blockage and a severe blockage.

With a mild blockage, a person can speak, cough, or gag. This type of blockage is typically cleared naturally through forceful coughing. Allow someone with a mild blockage to try and resolve the problem on his or her own. Stay close and be ready to take action if things worsen.



Severe Obstruction

When a severe blockage occurs, a person cannot take in enough air to dislodge the object. Signs of severe obstruction include very little or no air exchange, lack of sound, and the inability to speak or cough forcefully. The person may hold his or her hands to the throat while attempting to clear the obstruction.

A person without any air exchange requires your help to survive.



Children and Infants

Young children are particularly at risk for choking because of the small size of their air passages, inexperience with chewing, and a natural tendency to put objects in their mouths.

For a choking child, the approach is nearly the same as for adults. It might be easier to kneel behind a choking child to deliver thrusts. Use less force on your thrusts.

Since infants do not speak, it may be more difficult to recognize choking. A sudden onset differentiates it from other breathing emergencies. Signs include weak, ineffective coughs, and the lack of sound, even when an infant is clearly attempting to breathe.



Pregnant or Obese

When someone is clearly pregnant or obese, use chest thrusts instead of abdominal thrusts. Position yourself directly behind the person. Reach under the armpits and place the thumb side of your fist on the center of the chest. Grasp your fist with your other hand and thrust straight backward. Try to not put pressure on the ribs.

Self-Care

If you are choking and alone, try pressing your abdomen quickly against a rigid surface, such as falling onto the back of a chair. If one is not available, attempt abdominal thrusts on yourself.



Knowledge Check

You are in the company cafeteria eating lunch with a coworker. He is laughing at something you said when he suddenly stops, grasps his throat with his hands, and stands up quickly. He clearly looks distressed, so you stand up next to him and ask, "Are you choking?" He is unable to answer you and completely silent. You decide to perform abdominal thrusts. Describe how to perform them.

Choking — Adults



Assess Person

- Ask, “Are you choking?”
- If person nods yes, or is unable to speak or cough, act quickly.
- If available, have a bystander activate EMS.



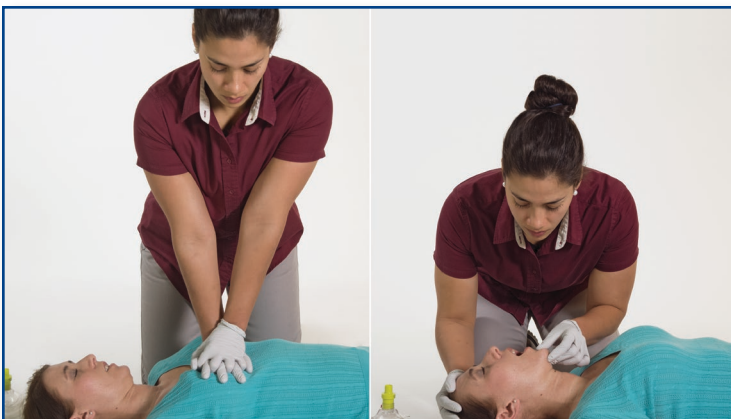
Position Yourself

- Stand behind person. Reach around and locate navel.
- Make a fist with other hand and place thumb side against abdomen, just above navel and below ribs.
- Grasp fist with other hand.



Give Thrusts

- Quickly thrust inward and upward into abdomen.
- Repeat. Each thrust needs to be given with intent of expelling object.
- Continue until person can breathe normally.



If Person Becomes Unresponsive

- Carefully lower person to ground.
- If not already done, activate EMS and get an AED, if one is available.
- Begin CPR, starting with compressions.
- Look in mouth for an object before giving rescue breaths. Remove any object seen.
- Continue CPR until person shows obvious signs of life, or another provider or EMS personnel take over.

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