

Pediatric

CPR, AED, and First Aid



**AMERICAN
SAFETY &
HEALTH
INSTITUTE**

Pediatric CPR, AED, and First Aid Student Book, *Version 8.0*

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Cardiac Arrest



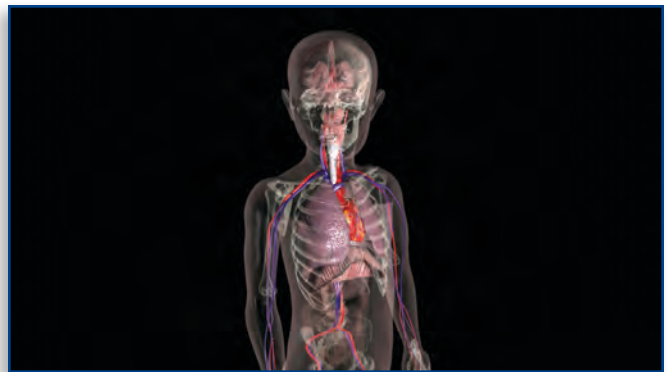
Because the human body cannot store oxygen, it must continually supply tissues and cells with oxygen through the combined actions of the respiratory and circulatory systems.

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. 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, cell damage, and death, can occur within a matter of minutes.



Secondary Cardiac Arrest

Cardiac arrest is the loss of the heart's ability to pump blood to the body. Cardiac arrest in children is usually the end result of the loss of breathing. This is known as secondary cardiac arrest.

Causes of secondary cardiac arrest include the following:

- Sudden Infant Death Syndrome (SIDS)
- Suffocation
- Entrapment
- Drowning
- Choking
- Drug overdoses

With no incoming oxygen, the heart progressively becomes weaker until signs of life become difficult or impossible to assess.



SIDS

Sudden Infant Death Syndrome (SIDS) is the sudden and unexplained death of a baby under one year of age. Because many SIDS babies are found in their cribs, it is often referred to as “crib death.”

The exact cause of SIDS is not yet known, but it is the leading cause of death in babies after one month of age. Most deaths occur in babies who are between 2 and 4 months old.

Babies placed on their stomachs to sleep are much more likely to die of SIDS than babies placed on their backs.

For more information about SIDS and the National Institute of Child Health and Human Development's Back to Sleep campaign, visit <http://www.nichd.nih.gov/sids/>

There are other causes of sudden unexpected infant death that occur during sleep, including suffocation, asphyxia, and entrapment. The American Academy of Pediatrics recommends focusing on a safe sleep environment to reduce the risk of all sleep-related infant deaths, including SIDS. These recommendations include use of a firm sleep surface, breastfeeding, room-sharing without bed-sharing, routine immunizations, consideration of using a pacifier, and avoidance of soft bedding, overheating, and exposure to tobacco smoke, alcohol, and illicit drugs.⁹

Cardiopulmonary Resuscitation (CPR)

Cardiopulmonary resuscitation (CPR) is the immediate treatment for cardiac arrest. CPR restores limited oxygen to the brain through a combination of chest compressions and rescue breaths.

When a child's heart stops or is too weak to create obvious signs of life, early CPR, with an emphasis on effective rescue breaths, offers the best chance for survival.¹⁰

CPR skills vary a bit, depending on age. 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.



Pediatric Chain of Survival

The pediatric chain of survival is often used to describe the best approach for treating a child in cardiac arrest. Each link in the chain is essential for a child to survive. If a single link is weak or missing, the chances for survival are greatly reduced. The greatest chance exists when all the links are strong.

- Prevention of the typical causes for airway and breathing emergencies
- Early CPR, with an emphasis on effective rescue breaths
- Prompt activation of EMS to quickly get professional care
- Effective basic and advanced EMS care and transport, and
- Effective post-cardiac arrest care at a hospital

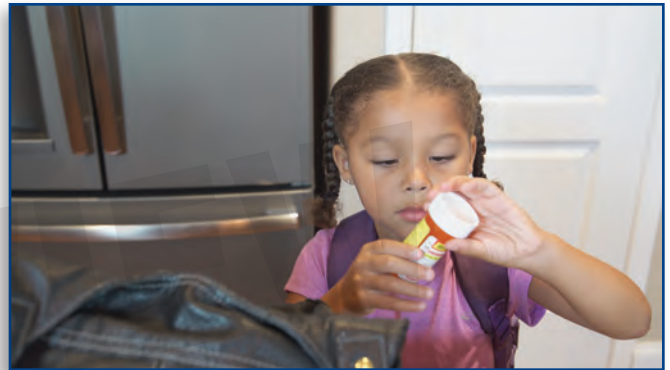


Opioid Overdose

The abuse of opioid drugs 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, is also contributing to the problem.

As a result, overdoses and deaths from prescription opioids and heroin have risen dramatically among both adults and adolescents.¹¹ With wider availability, the chance of an accidental overdose of a young child has also increased. 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. Naloxone is becoming more readily available to those without formal medical training.



Sudden Cardiac Arrest

Different than secondary cardiac arrest, sudden cardiac arrest primarily affects adults. It can happen with little or no warning. Victims abruptly become unresponsive and collapse. Abnormal gasping can occur. Breathing stops.

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

CPR

CPR is the immediate treatment for sudden cardiac arrest. 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.

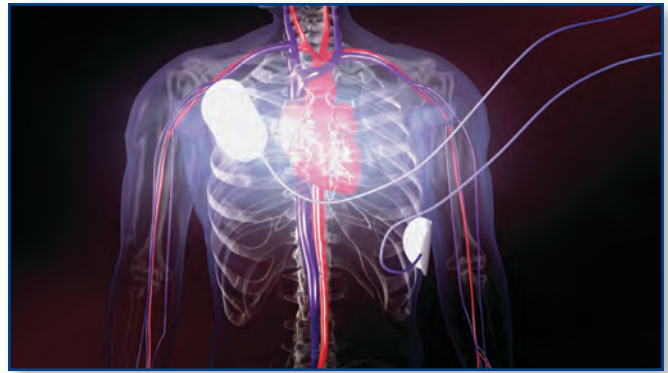
Successful defibrillation is highly dependent on how quickly defibrillation occurs. For each minute in sudden cardiac arrest, the chance of surviving goes down by about 10 percent. After as few as 10 minutes, survival is unlikely.

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 victim is usually longer than 10 minutes.

An automated external defibrillator, or AED, is a 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, hotels, and workplaces.

Turning on an AED is as simple as pushing a power button. Once on, an AED provides voice instructions to guide an operator through its use.

An AED automatically analyzes the heart rhythm to determine if a shock is needed. If a shock is advised by the AED, the operator clears the person and pushes a button to deliver the shock.



Adult Chain of Survival

The adult chain of survival is often used to describe the best approach for treating sudden cardiac arrest.

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

Sudden Cardiac Arrest in Children

Although rare, children can experience sudden cardiac arrest with ventricular fibrillation due to existing heart problems or an accident such as a blow to the chest or an electrocution. When available, include the use of an AED when cardiac arrest of a child or infant occurs.



Knowledge Check

The adult 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 first aid provider. Describe those links.

Chest Compressions



There is a set of basic CPR skills used to treat cardiac arrest:

- Chest compressions
- Rescue breaths
- Use of an automated external defibrillator
- Checking for life-threatening emergencies using a Primary Assessment

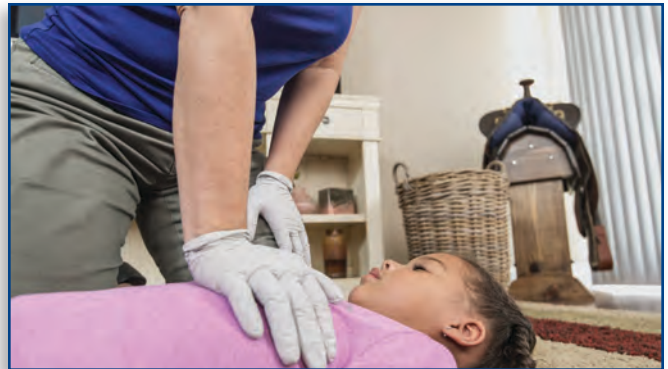
External compression of the chest increases pressure inside the chest and directly compresses the heart, forcing blood to move from the chest to the lungs, brain, and the rest of the body.

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

- Compress deeply, at least 1/3 the depth of the chest or about 2 inches.
- Compress fast, between 100 and 120 times a minute.
- Get close and do not lean on the chest. Allow the chest wall to fully recoil, or rebound, at the top of each compression.

Compression rate can be improved during practice with the use of a device such as mobile metronome app.

Compressions can be tiring. If you need to, use two hands to perform compressions on a child.



Adults

The two-handed compression technique is also used for adults.

For an adult:

- Compress deeply, at least 2 inches.
- Compress fast, between 100 and 120 times a minute.
- Get close and do not lean on the chest. Allow the chest wall to fully recoil, or rebound, at the top of each compression.



CPR feedback devices measure things such as depth, rate, and timing are available to improve adult compression quality during practice.

When compressing properly on an adult, 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.

Infants

Infant chest compressions are performed using the tips of two fingers just below an imaginary line drawn between the nipples.

For an infant:

- Compress deeply, at least 1/3 the depth of the chest or about 1 1/2 inches.
- Compress fast, between 100 and 120 times a minute.



Knowledge Check

What are 3 measures of high-quality chest compressions for a child?

Chest Compressions — Children



Position Your Hand(s)

- 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.



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 waist, use upper body weight to push straight down 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.

Chest Compressions — Adult



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 — Infants



Positioning

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



Compress

- Compress at least 1/3 depth of chest, or about 1 ½ 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.

PREVIEW

Primary Assessment — Unresponsive



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.

Before anything else, pause and assess the scene for hazards. If the situation is dangerous to you, do not approach.

If safe, begin by checking for responsiveness. Tap or squeeze the shoulder and ask loudly, “Are you all right?” For an infant, tap the foot.

If unresponsive, have a bystander activate EMS and get an AED.

Quickly look at the face and chest for normal breathing. Take no longer than 10 seconds. Normal breathing is effortless, quiet, and regular.

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 you are unsure, assume breathing is absent.

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

If the child is breathing normally, and uninjured, place him or her in a side-lying recovery position to help protect the airway.



When Alone During a Primary Assessment

If you are alone with an unresponsive child, use a mobile phone, if available, to activate EMS yourself. The speaker function will allow you to talk with the EMS dispatcher and provide care at the same time. If you need to leave the child to activate EMS or get an AED, provide about two minutes of CPR before you go. Return as quickly as you can.

Recovery Position

The recovery position is the same for all ages. It helps protect the airway by using gravity to drain fluids from the mouth and keep the tongue from blocking the airway.

After a child is placed in a recovery position, frequently assess and monitor breathing. The child's condition could quickly become worse and require additional care.

If child has been seriously injured, do not place in a recovery position unless fluids are in airway, or you need to leave to get help.

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 fourth grade student collapses near you during a student assembly. As a trained pediatric first aid 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 a nearby teacher to activate EMS and get an AED. As you look closely at the face and chest for breathing; he makes a brief gasping short, but then remains still. What do you do next?

PREVIEW

Primary Assessment — Unresponsive



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?”
- For an infant, tap the foot.
- If unresponsive, have someone activate EMS and get an AED.



Look for Normal Breathing

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

Recovery Position



Prepare

- Place arm nearest you up alongside head.
- Bring far arm across chest and place back of hand against cheek.
- Grasp far leg just above knee and pull it up so the foot is flat on ground.



Roll

- Grasping shoulder and hip, roll child toward you in a single motion, keeping head, shoulders, and body from twisting.
- Roll far enough for face to be angled toward ground.



Stabilize

- Position elbow and legs to stabilize head and body. Ensure there is no pressure on chest that restricts breathing.
- Make sure head ends up resting on extended arm and head, neck, and body are aligned.

Swollen, Painful, or Deformed Limb



External force to a limb can result in an injury to the underlying skeletal system.

Bones, muscles, and joints give the body shape, allow movement, and protect vital internal organs. Long bones form the upper and lower parts of each limb. Muscles, ligaments, and tendons attach to the bones, allowing for movement where the bones come together at joints. These bones are the most exposed to injury.

There are four different types of injuries affecting bones, muscles, and joints:

- Strains are stretching or tearing injuries to muscles or tendons.
- Sprains are tearing injuries to ligaments that hold joints together.
- Dislocations are the separation of bone ends at a joint.
- Fractures are breaks in bones.

Common signs of these types of injuries include swelling, pain, numbness, and discoloration. Distinguishing the type of injury is often difficult. It is best to treat everything as a possible fracture.

The limb may appear deformed and the child may guard it by holding it against her body. Unstable bones or joints can damage surrounding tissue. Encourage the child to not move or use the injured limb. If the injury seems serious, or you are not sure, activate EMS.

Expose the injury site by gently cutting or tearing away clothing. An open wound may be present in association with a fracture. Control any bleeding using a clean dressing and firm, continuous, direct pressure on the bleeding site. Do not push a bone back under the skin.

Use padding in the gaps around the limb to provide a stable and comfortable spot for the limb to rest. If needed, place your hands above and below the injured area to help immobilize the limb. Local cooling can help decrease bleeding, swelling, and pain.

Local Cooling

For many injuries, local cooling can help decrease bleeding, swelling, and pain. A plastic bag filled with a mixture of ice and water works best. Place a thin cloth between the bag and skin to prevent cold related problems. Limit application to 20 minutes or less.

It is best to not straighten an injured limb that is unnaturally angled. Leave the limb in the position found. If a limb becomes blue or extremely pale, circulation may be compromised by the injury. If you have not yet done so, activate EMS if this occurs.

Splinting an injured limb can reduce pain and prevent further injury, especially when moving an injured child. In general, it is best to rely on EMS personnel to splint, as they have more extensive training, experience, and equipment.

Comfort, calm, and reassure the child. Reassess the child and injury regularly until EMS personnel take over.



Knowledge Check

While playing outside, a young child trips and falls onto her outstretched arm. She is awake, crying, and appears to be in severe pain. As a responding pediatric first aid provider, you carefully expose the injury site and see the forearm near the wrist is bent at an unnatural angle. The child's hand beyond the injury is a purplish-blue color. What do you do?

PREVIEW

Manual Stabilization of a Limb



Expose Injury

- Encourage child not to move injured limb.
- Expose injury site to look for an open wound.



Cover Open Wounds

- Cover an open wound with a clean absorbent pad.
- Gently control bleeding with firm, continuous, direct pressure around bone or injury site.
- Never push an exposed bone back under skin.



Stabilize Limb

- Leave injured limb in position it was found.
- Use padding in gaps and holes underneath limb to provide a stable and comfortable spot for it to rest.
- If needed, use your hands to manually stabilize limb.



Additional Considerations

- If injury seems serious, or you are not sure, activate EMS.
- Comfort, calm, and reassure child.
- Local cooling can help decrease bleeding, swelling, and pain.

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