Cardiopulmonary Resuscitation

KEY TERMS
- advanced lividity
- Heimlich maneuver
- intermammary line
- McGill forceps
- return of spontaneous circulation (ROSC)
- rigor mortis
- signs of circulation

OBJECTIVES
Upon completion of this appendix, the reader should be able to:
1. Define sudden cardiac death.
2. State the purpose of CPR.
3. Discuss situations when CPR would be withheld.
4. Demonstrate how to check for responsiveness.
5. Demonstrate how to open an airway.
6. Discuss the meaning of “look, listen, and feel.”
7. Demonstrate palpation of the carotid artery.
8. Discuss advantages of compression technologies.
9. Describe how an EMT would handle special situations that are unique to EMS.
10. Explain the differences between layperson CPR and EMT CPR.
11. Describe how an EMT interfaces with a bystander performing CPR.
12. Describe the sequence of steps used to relieve a foreign body airway obstruction.
13. Describe the anatomical differences between children and adults that makes CPR different from one to the other.
14. Describe CPR for a newborn, an infant, and a child.

OVERVIEW
Sudden cardiac death, an unexpected death within 1 hour of the onset of cardiac symptoms, is typically the result of ventricular fibrillation. In most cases the definitive treatment for ventricular fibrillation is defibrillation with an automated external defibrillator (AED), as discussed in Chapter 29.

However, in cases when an AED is not readily available an emergency medical technician (EMT) may be required to perform cardiopulmonary resuscitation (CPR) until the AED arrives. CPR in those
cases is performed in order to maintain circulation to the brain and the heart until the fibrillating heart can be defibrillated, or “shocked,” back into a normal pulse-producing, life-sustaining rhythm. Therefore, it is imperative that EMTs know how to perform CPR. This appendix reviews the rudimentary principles of CPR for the EMT.

Note: Many states require EMT students to obtain certification in CPR before they begin the EMT course. Other states require EMTs to recertify their CPR certification or obtain one during the EMT class. In any case, EMTs are well served if they review and practice the skills of CPR during the EMT course. EMTs need to be experts at CPR.

CARDIAC ARREST AND CPR

It is important for the EMT to understand that CPR is only a stopgap measure intended to preserve the brain and heart until the arrival of the AED and a subsequent conversion, by defibrillation, of the deadly rhythm into a pulsed rhythm.

While there are reports of a return of spontaneous circulation (ROSC) with CPR alone, that is, pulses returning with just CPR, these cases are rare, and the patient’s survival more likely depends on the well-timed use of an AED.

For every minute of delay getting an AED to the patient, survival from ventricular fibrillation and sudden cardiac death decline by approximately 7–10%; therefore, the first priority in emergency care is to get an AED to the patient.

Conversely, studies have shown that timely arrival of an AED, in many cases preceded by lay person CPR, can result in survival rates from 49% to 74%.

CPR is also performed whenever a patient has been in collapse for a prolonged time and the AED indicates “no shock advised.” In those cases, CPR is intended to help convert the nonshockable asystolic rhythm into a shockable rhythm, such as ventricular fibrillation.

Heart Attack at Airport

Bonnie and Mike were finishing cleaning up the ambulance from the last call when the tones went off and the announcement proceeded.

“Ambulance 1957, Medic 15 respond to the airport lobby, man having a heart attack.”

As Bonnie climbed into the driver’s seat she remembered the last cardiac call she had at the airport. It was a full arrest and airport security and a couple of off-duty flight attendants were already on scene performing CPR and using the AED. It was a save, thanks to the good work of those citizens.

- What unique challenges do EMS providers face when confronted with citizens performing CPR or using an AED?
- How does the EMT interface with citizen CPR?
- Are there any differences between citizen CPR and rescuer CPR?
CPR is also performed in cases of near-cardiac arrest; for example, the patient who is in respiratory failure/arrest and the EMT performs rescue breathing, forestalling the inevitable cardiac arrest that would normally follow. This case is especially true in children, who more often die from respiratory failure than from cardiac disease.

**EMS and Cardiac Arrest**

“Unknown, man down” or “person collapsed, CPR in progress” can alert the EMT to the possibility of cardiac arrest and the need for CPR. However, many cardiac arrest calls start out less clear. Some callers will report a patient having a seizure, the last convulsion of an oxygen-starved brain before death. Other callers will report a person with difficulty breathing, as the patient takes his last agonal breath. Because cardiac arrest can sometimes be sudden and unexpected, the EMT must always be prepared to perform CPR if needed.

When exiting the emergency vehicle on the scene of a suspected cardiac arrest the EMT should have a selection of airway devices, including suction, oxygen, and a bag-valve-mask (BVM) as well as an AED. Despite the excitement and anticipation surrounding a cardiac arrest, when the EMT first enters the scene the initial consideration must be given to scene safety. This is especially true if more than one person has collapsed. Paying no heed to signs of danger leaves the EMT at risk of being the next victim.

**Obvious Death and DNR**

In some cases death is obvious and it may not be appropriate to start CPR on the patient. For example, if the patient has *advanced lividity*, pooling of blood in the dependent portions of the body with a clear line of demarcation, or *rigor mortis*, a generalized stiffening of the body following death, then CPR may not be indicated. Other reasons to withhold CPR include decomposition of the body, incineration of the body, decapitation, hemicorporectomy (division of the body in half), and other obviously mortal wounds. The EMT should follow medical protocols regarding when to withhold CPR.

If family or bystanders are present the EMT should inquire about a do not resuscitate (DNR) order. Some jurisdictions permit an EMT to honor a DNR order in the field. If the DNR can be produced and the EMT, following medical protocols, can honor the DNR, then CPR should not be started. If there is a delay in obtaining the DNR, the EMT might consider starting CPR while trying to contact medical control for more direction.

**Responsiveness**

While donning personal protective equipment, minimally a pair of gloves and goggles, the EMT should decide if the situation is a medical circumstance or a trauma circumstance. This decision impacts the EMT’s early care of the patient. If the patient is a trauma patient, the EMT should first maintain manual in-line cervical spine stabilization, provided there is a sufficient number of rescuers to maintain stabilization and perform CPR. If the patient is a medical patient, then manual in-line cervical spine stabilization is unnecessary.

Next the EMT must establish the patient’s level of responsiveness. First, the EMT should call out to the patient, preferably using the
patient’s name. If there is no response, then the EMT should call out to the patient again, this time much more loudly. If the patient still remains unresponsive, the EMT should tap him on the shoulder to determine unresponsiveness. Patients who appear unresponsive may actually be in deep sleep. The EMT should then proceed to give the patient a painful stimulus, like a sternal chest rub. If there has been no response to loud verbal and painful stimulus, then the patient is determined to be “unresponsive.”

If the decision is made to start resuscitation, it may be necessary to move the patient from the position in which he was found. The patient should be positioned supine on a firm surface, such as the floor or a backboard. It may be necessary to drag the patient off a bed and onto the floor before CPR can begin. If the patient has a suspected cervical spine injury, efforts should be made to maintain neutral cervical spine alignment. Often a long axis drag coupled with manual in-line cervical spine stabilization is all that is needed.

A minimum of time should be taken to move the patient to a firm surface. Delays getting a patient to another room, for example, decrease the patient’s chances of survival.

**Airway**

With the patient on the firm surface, and the rescuer typically positioned at his side, the airway must next be opened. The tongue of an unconscious patient can obstruct the airway, so the head must be repositioned to open the airway. The method used for the medical patient, when no neck injury is suspected, is the head-tilt, chin-lift, as illustrated in Figure B-1.

Placing the heel of one hand on the forehead of the patient and using the index finger and thumb to grasp the mandible (chin), the EMT gently tilts the head backward, feeling for resistance. If resistance is felt it may mean that the patient has a neck injury or another reason for limited neck mobility, requiring the EMT to use the jaw thrust maneuver.

If the patient is a suspected trauma patient, or has limited neck mobility, then the EMT should reposition at the head of the patient and, reaching toward the chest, grasp the angle of the patient’s lower

![FIGURE B-1](image) The head-tilt, chin-lift airway technique.
jaw with both hands, placing the thumb on the patient’s zygoma (cheekbones) and lifting the jaw upward. These two airway maneuvers are discussed in Chapter 7.

The EMT should understand that all manual airway maneuvers can cause cervical spine movement, with or without manual in-line cervical spinal stabilization. The primary objective of manual airway maneuvers is to open and maintain an airway by any means necessary. Typically a lone EMT first arriving at the side of the suspected sudden cardiac arrest patient will need to employ the head tilt-chin lift technique of opening the airway.

There is no evidence that the use of a cervical immobilization device improves airway positioning and using one may make basic airway management more difficult.

Frequently, when the EMT opens the airway and inspects the oropharynx, secretions or vomitus will be present. If this is the case the airway should be aggressively cleared; first manually, then mechanically.

If large pieces of food are seen, the EMT should use the forefinger like a hook and scoop out the pieces. To prevent the EMT’s fingers from being bitten, a bite block, such as a large oral airway inserted sideways between the molars, can be used. The EMT should then proceed to mechanically suction to remove the remaining secretions.

If these secretions are not removed and the patient is ventilated, either by mouth-to-mouth rescue breathing or with a BVM, they will be forced into the lungs and cause an aspiration. Aspirated secretions can block narrow airways, and prevent adequate ventilation of the lung.

However, time is critical in these cases. The EMT should only grossly clear the airway of secretions and then proceed quickly to the next step of assessment.

**Breathing**

With the airway opened, the EMT should proceed to checking for breathing. The mnemonic “look, listen, and feel” summarizes the three-step approach to verifying the presence or absence of breathing (Figure B-2). The EMT should turn her head and place her ear near the patient’s mouth. In that position, the EMT should look to see if there is adequate chest rise, listen for the sound of breathing from the mouth, and feel the breath against the cheek for a minimum of five seconds and a maximum of 10 seconds.

If the patient is breathing and just unconscious, the EMT should evaluate the quality of the breathing. Breathing that is slow and agonal is not adequate and the EMT should suspect cardiac arrest. In those cases, the patient should be supported by either rescue breathing or a bag-mask-device and CPR should be continued.

If the patient is breathing adequately, then the EMT should proceed with the rest of the initial assessment, taking precautions in the case of suspected cervical spine injury.

If the patient is not breathing, then the EMT should proceed to breathe for him by either doing rescue breathing or using a bag-mask-device. The procedure for using a bag-mask-device is discussed in Chapter 8. Figure B-3 illustrates mouth-to-mouth rescue breathing; it should be noted that the face shield is present but not visible.

If the EMT is going to perform mouth-to-mouth rescue breathing then she should use a barrier device or pocket mask and provide two
breaths, each over one second, that cause the chest to start to rise without causing the stomach to rise.

If the patient has had a laryngectomy then the EMT should perform either mouth-to-stoma ventilation or use a round pediatric face mask over the tracheal stoma, either in combination with a bag-mask-device or in a manner similar to a pocket mask.

Overinflation of the lungs can cause air to spill over into the esophagus and stomach. Gastric filling can result in decreased lung expansion and regurgitation followed by aspiration. To prevent this problem the EMT could consider using cricoid pressure, provided sufficient personnel are on hand to assist.

The entire process of assessing for breathing should take about 10 seconds. It is important to adequately check for breathing. A quick assessment of breathing may miss the person who is breathing agonally, while a prolonged assessment of breathing, greater than 10 seconds, may delay the time to defibrillation.

**Circulation**

After delivering two breaths, each over one second, the EMT should proceed to check the patient for a pulse. In adults, the pulse is verified at the carotid artery in the neck. A pulse here generally indicates that the brain is getting blood flow.

To find a pulse the EMT should place her forefingers on the patient’s larynx (Adam’s apple) at the midline of the anterior portion of the throat then proceed, on the side closest to the EMT, to run the fingers posteriorly until they fall into a groove, about two or three finger breadths below the larynx. The carotid artery is found in the groove created by the sternocleidomastoid (SCM) muscle, also known as the strap muscle. The EMT should maintain the head-tilt, using one hand on the forehead. This position makes palpating (feeling) the carotid artery easier.

Finding a pulse on a living person is relatively easy; confirming the absence of a pulse on a pulseless patient is more difficult. The EMT should frequently practice finding the carotid pulse so during an emergency it can be found quickly and easily.

Once the EMT has found the carotid artery pulse point, she should palpate (feel) for a pulse for approximately 10 seconds and no more. If the EMT is unsure of the presence or absence of the carotid pulse, and the patient has no signs of circulation (i.e. breathing, spontaneous movement or coughing), then the EMT should start CPR.

If a pulse is present, then the EMT should proceed with the rest of the initial assessment. If the pulse is absent, then the EMT should proceed to chest compressions.

If the EMT suspects that the patient is hypothermic from the cold, a longer pulse check may be necessary. Some experts advocate taking as long as 30 seconds to confirm pulselessness. The EMT should follow the medical control protocol for assessing and treating hypothermia in these cases.

**Chest Compressions**

After confirming pulselessness, the EMT performs external chest compressions, also known as cardiac massage. Chest compressions are a series of rhythmic compressions of the anterior chest in order to compress the heart and great vessels and, in turn, create a blood flow to the vital organs.
It should be noted that even expertly performed manual CPR only produces about 25% of normal blood flow, an inadequate blood flow to sustain life. It is imperative that the heart start pumping on its own, that is, to restart the heart, using the defibrillator.

Recent research has increased the emphasis of quality of cardiac compressions. The current American Heart Association recommendations state, “push hard, push fast.” This renewed emphasis on chest compressions reflects current theory that to be effective in sustaining cerebral and coronary perfusion, the compressions must be rapid and deep.

Rather than having EMTs perform manual chest compressions some EMS systems use a circumferential compression machine, for example, the Autopulse® made by the Revivant Company. This machine provides a consistent rate and depth of compression as well as a dependable 50/50 cycle of compression to relaxation. Machines such as this one can be deployed quickly, perform a consistent depth and rate of compressions, and adjust to each patient. However, its greatest advantage, as illustrated in Figure B-4, may be that it helps to free the EMT to attend to other functions, such as helping to maintain the airway.

**Hand Position**

To perform manual external chest compressions the EMT must first expose the patient’s chest in order to find landmarks for proper hand placement. If the patient is a woman, it is unnecessary to cut or remove her brassiere, as important landmarks are readily visible without it.

To find proper hand position for compressions on an adult patient, the EMT should identify the center of the patient’s chest and place the heel of the dominant hand on the center of the chest. Then place the non-dominant hand on top of the dominant hand.

The EMT may choose to either interlace fingers or extend them to keep them off the chest wall. If the EMT has a weak, or arthritic, wrist, she may choose to grasp her own wrist with the other hand to support it. This added support can help the EMT produce more force on the compressions.

The EMT should take the time to quickly find the proper placement of the hands. Compression of the bottom portion of the sternum may result in injuries to the liver, spleen, and stomach, while compressions of the upper half of the sternum will not be effective.

While kneeling, with legs slightly apart and with both hands positioned perpendicular to the long axis of the sternum, the EMT should then raise her body up until her shoulders are directly over the patient’s chest.

Next the EMT should lock her elbows, leaving her arms straight. This permits the EMT to use shoulder and back strength to produce the force of compression. Arm muscles quickly tire after only a few minutes of compressions, but the back and shoulder muscles are more capable of sustaining the compressions for a longer period of time. Figure B-5 illustrates proper position of the EMT to perform compressions.

The EMT then compresses the sternum downward, toward the ground, approximately 11/2–2 inches in depth (4–5 cm). Production of a carotid or femoral pulse may be evidence of adequate depth compression, however compressions should not be interrupted to feel for a carotid pulse. Figure B-6 illustrates palpation of a femoral pulse.

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**Street Smart**

Some EMTs have been trained to perform a “quick check.” To perform a quick check, the EMT opens the airway and checks for breathing and a pulse simultaneously. While this technique reduces the time from collapse to defibrillation, it takes a great deal of practice to perform it correctly.
Duty Cycle
While compressions are important, the time for decompression of the chest wall, during which coronary blood flow occurs as well as ventricular filling, may be just as important. The EMT should strive to make the cycle of compression and release, also called the duty cycle, approximately equal, that is, 50% compression and 50% relaxation. The relaxation time allows for the ventricle to fill with blood and the rescuer to rest. During the relaxation phase the EMT should leave her hands resting gently on the chest wall, allowing complete chest wall recoil during decompression. Lifting the hand slightly off the chest wall is acceptable but the EMT should remain vigilant about maintaining proper hand position.

Rate and Ratio
With practice, the EMT can achieve a rhythmic compression at a rate of approximately 100 compressions a minute or 30 compressions in about 20 seconds. The compression should not be abrupt, nor stabbing or springy, with the arms recoiling from every compression, but rather a steady rhythmic up-and-down motion.

The ratio of compressions to ventilations in the adult patient in cardiac arrest is 30 compressions to 2 ventilations (30:2) regardless of the number of rescuers.

In the case of children, when two EMTs are present, the ratio becomes 15 compressions to 2 ventilations (15:2).

Witnessed versus Unwitnessed Cardiac Arrest
A fundamental change in the approach to cardiac arrest management revolves around the question of witnessed versus unwitnessed cardiac arrest.

In the case of a witnessed arrest, the sequence of CPR should only be initiated while awaiting the placement of the AED pads. The theory of “shock first” only pertains to those arrests that EMS responders report just occurred, i.e. within less than four or five minutes.

In those cases the heart muscle may still be responsive to defibrillation.

In cases of unwitnessed cardiac arrest, or in cases where the patient has been in cardiac arrest for greater than four or five minutes, five cycles or approximately two minutes of CPR, may help prepare the heart for defibrillation.

If two EMTs are present then one will perform chest compressions while the second will ventilate the patient with either a bag-mask-device or pocket mask. The compression rate for two-rescuer CPR is the same as one-rescuer CPR, 100 compressions per minute, with a pause for ventilation every 15 compressions.

After two breaths that cause chest rise, approximately 500 cc in the average adult, are delivered to the patient, the EMT should resume compressions. This pattern of compressions and ventilations should continue for two minutes or five duty cycles. Figure B-7 illustrates the cycle of opening the airway, ventilating the patient (using a barrier device), and chest compressions.

Once the patient has been intubated by an advanced EMT, it is not necessary to interpose ventilations between compressions. In those instances compressions may be continuous while ventilations are delivered at a constant rate of 8–10 breaths per minute, that is, one breath every 5 seconds.
Compression Effectiveness

Frequently an EMT will be unaware of their fatigue and the fact that their compressions have become shallow or that their duty cycle is no longer 50/50.

In an effort to maintain high quality CPR, with a minimum of interruptions, the EMT should consider replacing the person doing compressions every 5 cycles. The switch can be performed while one rescuer performs a quick pulse check. But in every case, the interruption in compressions should not exceed 10 seconds.

Special Situations

The EMT performing CPR is doubly tasked to perform effective CPR while moving the patient toward the ambulance and to the hospital.

For ease of movement of the patient, an EMT may elect to place him on a backboard or similar rigid device, regardless of the presence or absence of spine injury. It is important that the EMT tell emergency department personnel, upon arrival, that the patient is not a trauma patient and that the backboard was used as a convenience for moving the patient.

If the patient lives in an upper story of a building, it will be necessary to move him down to the ground floor and to the awaiting ambulance. In some instances the elevator will accommodate the patient lying supine. In many cases the patient will have to be carried down the stairs. In those instances, the CPR should be performed for a minimum of 1 minute and the patient reassessed. “If no pulse is found then the patient should be moved quickly to the next landing, or to the foot of the stairs, for defibrillation and CPR should resume for at least another minute. If necessary, the process can resume for each flight of stairs.

Once on the ground floor the patient should be placed on the ambulance stretcher, with the stretcher remaining in the low position. The EMT can continue ventilations and compressions while the stretcher is moved to the ambulance.

As space inside an ambulance is often limited, it may be necessary for the EMT to either kneel beside the patient to continue compressions or to straddle the stretcher, placing her back against the ceiling, and bracing her legs against the walls of the ambulance.

If the patient is immediately transferred to a high hospital gurney upon arrival at the emergency department, it may be necessary for the EMT to climb aboard the gurney and kneel beside the patient. From this position an EMT might easily fall, so care should be taken to prevent the fall.

FIGURE B-7 The cycle of airway, breathing, and circulation.
Bystander CPR

An EMT may come across a bystander who is performing CPR, presenting some unique challenges to the EMT when working with these good Samaritans, because there are several differences between layperson CPR and the CPR that an EMT is trained to do.

To begin, the bystander may not have checked a pulse before beginning CPR. Several studies have indicated that laypeople are unfamiliar with, and have trouble finding, the carotid pulse; bystanders err in correctly assessing for a pulse approximately 35% of the time.

For this reason lay rescuers are taught to assess for signs of circulation, such as responsiveness, breathing, coughing, and movement, instead of a carotid pulse. If the EMT should ask the bystander, “Did the patient have a pulse?” she is likely to get a quizzical look from the bystander.

Next, the EMT may observe that no ventilations are being performed. The bystander is performing compression-only resuscitation. Many bystanders are reluctant to perform mouth-to-mouth rescue breathing, particularly on a stranger, and especially in the absence of a barrier device such as a face shield.

Or the bystander may have received instruction on CPR from an emergency medical dispatcher. These EMS dispatchers can only provide limited instruction on the telephone and, to conserve time, provide bystanders with only instructions on how to perform compressions.

Finally, the bystander may be physically unable to perform ventilations, perhaps due to advanced lung disease. Some respiratory conditions prevent the well-meaning bystander from performing ventilations.

While true cardiopulmonary resuscitation is desirable, that is, both ventilations and compressions, compression-only resuscitation is better than no resuscitation efforts at all.

Bystander-EMT CPR

Bystanders are not taught two-person CPR, only one-person CPR. If the EMT arrives on scene, assuming that other EMS responders have been notified, and bystander CPR is in progress, the EMT has several options depending on circumstances.

If the bystander appears to be comfortable doing CPR, the EMT may ask if he or she wants relief. If told no, then the EMT should attend to other tasks and permit the bystander to continue one-person CPR. In the interim, while awaiting the arrival of more EMS, the EMT could assess the effectiveness of CPR by checking a carotid pulse, or preparing the bag-mask-device.

If the bystander appears exhausted, or the CPR ineffective, then the EMT can offer to relieve him or her. In those instances, the EMT should first confirm the absence of a pulse and then commence CPR as indicated. The bystander might be asked to assist other EMS responders with locating the patient. Figure B-8 shows a bystander helping with CPR.

Public AED Use and the EMT

With the increasing use of public AEDs, by flight attendants, casino security, lifeguards, and school teachers, for example, there is an increased likelihood that an EMT will encounter a bystander using one.
Assuming that the EMT is present because the bystander verified that the patient was unresponsive and therefore activated the EMS system, the EMT should allow the bystander to confirm that the patient is breathless and pulseless. After cardiac arrest has been confirmed, the EMT should proceed with five (5) cycles of CPR then the use of the AED.

If the bystander has already attached the AED pads, then the EMT should permit the bystander to continue with the sequence. An interruption to reconfirm pulselessness and apnea only delays defibrillation and decreases the chance of defibrillation success. Figure B-9 shows a citizen using an AED before the arrival of EMS. Figure B-10 shows the EMT using the AED after the bystander has delivered the first shock.

**ADULT FOREIGN BODY AIRWAY OBSTRUCTION**

While choking is common, it is a rare cause of cardiac arrest; as most people are able to clear their airway without assistance. For this reason, the first step in assisting a person who is experiencing an airway obstruction, typically from meat, is to allow him to attempt clearing his own airway as long as good air exchange occurs. During this time the EMT should remain with the patient and stand by in case of need.

It is when the patient has poor air exchange, as evidenced by cyanosis, a weak or weakening cough, and subsequent loss of consciousness, that the EMT must act.

Initially the EMT should ask the patient one question such as, “Are you choking? Can you speak?” The patient with an obstructed airway will be unable to speak and may clutch his neck, in a demonstration of the universal choking sign illustrated in Figure B-11.

With the victim either standing or sitting, the EMT should come around to the back of the patient and place her fist into the area just below the xiphoid process, midway and midline between the sternum and the umbilicus.

It may be necessary to perform chest thrusts instead of abdominal thrusts on obese patients whom the EMT cannot get her arms around. If the patient is obese, it may be prudent to have him lie down and then perform chest compressions. There is evidence that chest compressions can be as effective as abdominal thrusts.
Grasping the fist with the other hand, the EMT should perform forceful upward abdominal thrusts, also called the Heimlich maneuver. This series of forceful upward abdominal thrusts forces air out of the lungs and the trachea. It is often necessary to perform the procedure repeatedly until the obstruction is relieved or the patient becomes unconscious.

Signs that the obstruction has been relieved include seeing the object that has obstructed the airway forced out, the patient taking a gasp of air, or the patient speaking. Figure B-12 illustrates three positions to relieve obstruction.

If the patient becomes unconscious the EMT should help protect him from falling and striking his head, if possible. Then the EMT should be sure that EMS has been dispatched and that additional help, especially advanced life support, is on the way before proceeding.

Once the patient is on the floor, the EMT should immediately start CPR.

If the object is visible then the EMT should insert a gloved finger formed like a hook into the side of the mouth and scoop the object out. If there is concern about the patient biting then an oral airway may be placed between the molars to act as a bite block.

If the object is not visible then the EMT should attempt to deliver two rescue breaths. A finger sweep should only be used if the obstruction is visible. Instead the patient should be ventilated as it may be possible to get air past the obstruction if the patient’s throat has relaxed.

If after these two attempts the EMT is still unable to get a breath into the patient, then she should resort to abdominal thrusts or chest thrusts (for obese or pregnant patients) and repeat the sequence again.

**PEDIATRIC CPR**

It is rare for children to go into isolated cardiac arrest, unless they have congenital heart disease. Instead another event, usually respiratory in nature, precedes the cardiac event. For this reason the EMT should first perform rescue breathing before calling for help; phone fast for children as opposed to phone first for adults.

Newborns occasionally need stimulation to breathe and even ventilation, in approximately 5–10% of all deliveries. This subject is covered in Chapter 37 under newborn care.

The process of resuscitation for a child is similar to that of an adult, with the exception that was just noted about phone fast. The
The differences between pediatric resuscitation and adult resuscitation lie in the unique characteristics of a child’s anatomy.

The first difference is the airway of the child. A child’s head is noticeably larger in proportion to the body than is an adult head. For this reason it is important to pad the area behind the child’s chest to elevate the chest to a neutral position. While the size of children vary, a dependable measure of proper placement is when the opening of the ears is in line, horizontally, with the midline of the shoulder.

With the head in a neutral position, the EMT should gently open the airway. When using the head-tilt, chin-lift technique, the EMT should use caution placing her fingers in position. The soft underside of the chin can easily be displaced upward, pushing the tongue against the hard palate and obstructing the airway. Figure B-13 illustrates the airway position and ventilation of an infant.

If a child is suspected of having a foreign body obstruction, a common occurrence because of children’s smaller airways, the EMT should use the techniques described in the pediatric medical emergencies chapter (Chapter 39) to relieve the obstruction.

If the airway is clear then the EMT should assess for breathing, using the same look, listen, and feel technique described for adults. If the breathing appears at all distressed, that is, gasping and ineffective, then the EMT should ventilate the child.

Next the EMT should proceed to checking the child’s pulse. Depending on the size of the child either the carotid or brachial pulse will be palpated. The brachial pulse is palpated instead of the carotid, typically in children less than 1 year of age, when the EMT is unable to find landmarks on the throat because the child’s neck is short and chubby.

The brachial pulse is found on the inner aspect of the upper arm, proximal to the bicep muscle, midline between the elbow and the shoulder.

If no pulse is present the EMT should proceed with chest compressions, depressing the chest approximately one third to one half the depth of the chest, after finding the correct compression point.

The compression point for an infant less than 1 year of age is approximately one finger width below the imaginary line that runs between the nipples, also called the intermammary line. Figure B-14 shows the proper finger position for an infant for compressions.

Depending on the size of the infant, and the size of the EMT’s hands, it may be possible for the EMT to encircle the infant’s chest with her hands and perform compressions with the thumb. This technique is both effective and less tiring for some EMTs.

The compression point for a child is the same as for an adult, except only one hand is used to compress the chest approximately 1–1 1/2 inches. Figure B-15 shows the proper hand position for chest compressions on a child.

Compression to ventilation ratios for children follow the differences in vital signs. For example, newborns breathe faster and have faster heart rates. Therefore, compression to ventilation ratio for a newborn is 3:1.

For infants, children, and adults, the compression to ventilation ratio is 30:2 for the single EMT. For children who are pre-adolescent, the compression to ventilation ratio is 30:2 for one rescuer and 15:2 for two rescuers.
CONCLUSION

While under the best of conditions survival from cardiac arrest is poor, the knowledge that an EMT’s actions have saved even one person’s life can sustain her morale and reinforce the optimism that EMS can make a difference. For these reasons alone, the EMT should become expert in CPR, practice CPR in a variety of predictable scenarios, and learn to work as a member of a team.

TEST YOUR KNOWLEDGE

1. What is sudden cardiac death?
2. What is the purpose of CPR?
3. When would CPR be withheld from a pulseless patient?
4. What are the four steps of checking responsiveness?
5. What are the two main techniques for opening an airway, and when are they used?
6. What does the phrase “look, listen, and feel” mean?
7. What are some of the differences between citizen CPR and the CPR an EMT performs?
8. How would an EMT interact with a bystander performing CPR?
9. What are the anatomical differences between children and adults in relation to CPR?
10. What are the compression–ventilation ratios for infants, children, and adults?

INTERNET RESOURCES

- American Heart Association, http://www.americanheart.org
- American Red Cross, http://www.redcross.org

FURTHER STUDY