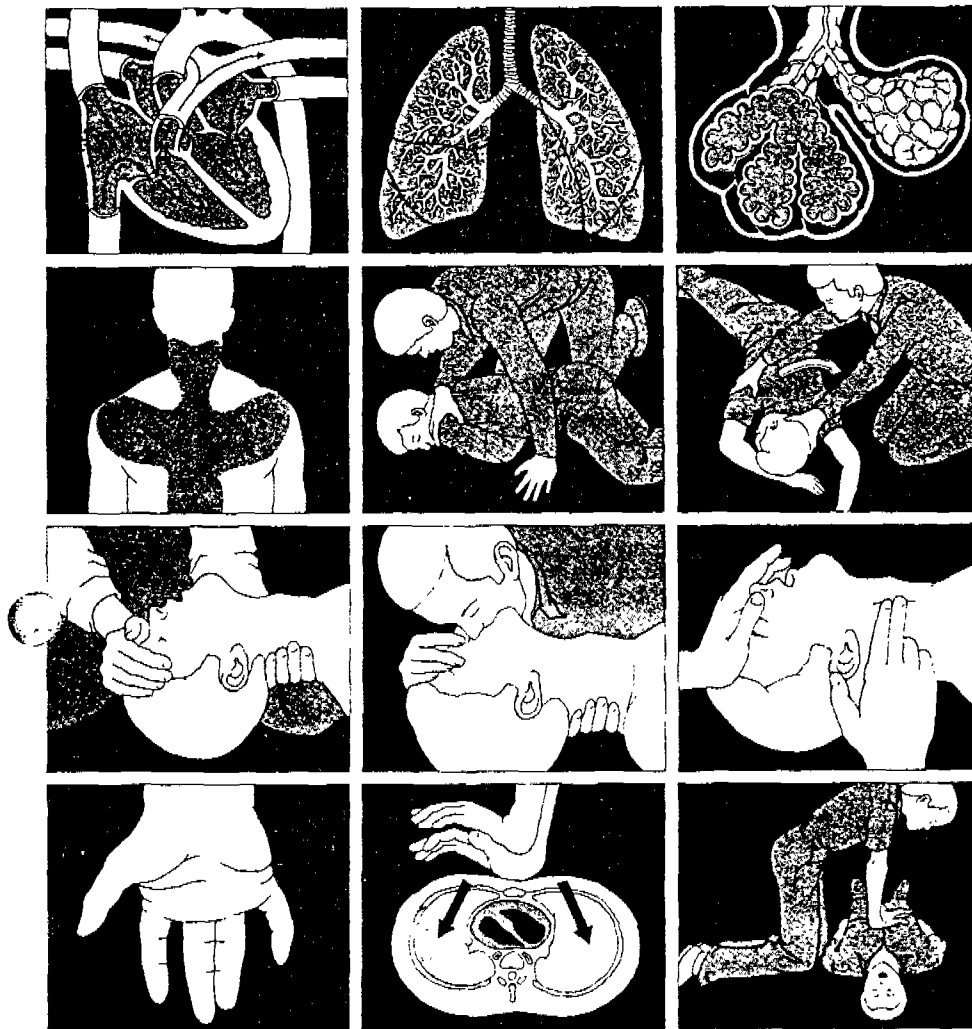


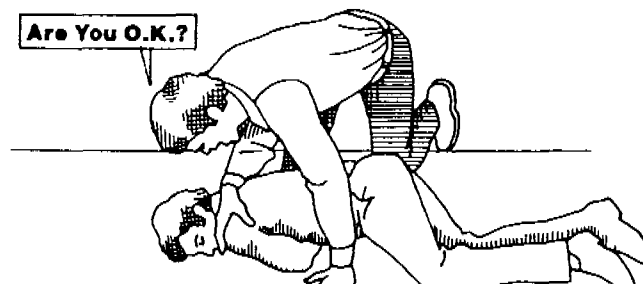
AMERICAN HEART ASSOCIATION

presents

TECHNICAL ASPECTS OF CPR TRAINING (INCLUDING THE NEW 1980 STANDARDS)

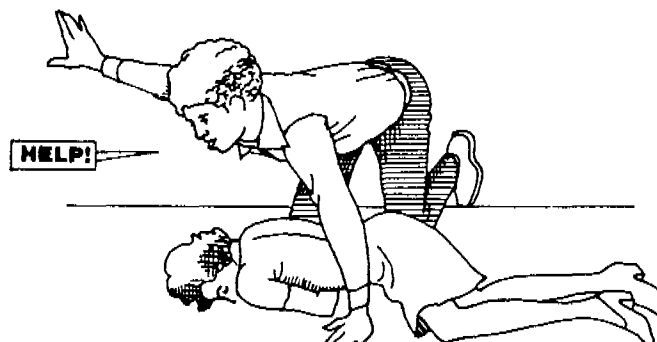


CARDIAC ARREST VICTIM ESTABLISHING UNRESPONSIVENESS



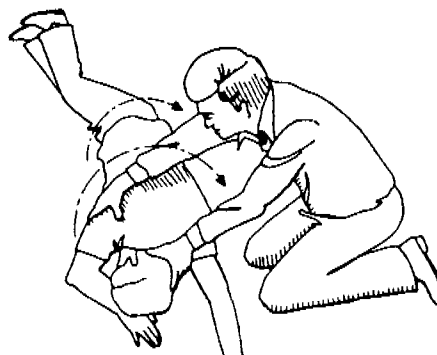
The rescuer should come up to the victim, gently shake his shoulder and ask, "Are you O.K.?" When one comes upon a person lying apparently unconscious, how can one tell whether he is, indeed, unconscious or if he is just sleeping? If the victim is not responsive, he is unconscious and may be in need of immediate CPR. Violent shaking may compound injuries that are present, particularly if neck injuries are present.

CALLING OUT FOR HELP



If the victim does not respond to your attempts to arouse him, call out for help. Even if no one is in sight, call out in the hope that someone will be within earshot who can assist you or go call an ambulance.

POSITIONING THE VICTIM



If the victim is crumpled up and lying face down, he's not in a position to begin CPR. So you must roll the victim over as you call for help.

You must exercise great care in rolling the victim over, for the individual may have broken bones or other injuries which could be complicated by improper technique.

Roll the victim as a unit so that the head, shoulders and torso move simultaneously with no twisting.

 You are going to kneel beside the victim, and place your hands so you can support the neck and roll the victim toward you.

Kneel beside the crumpled victim a few inches from his side. Raise the victim's arm which is nearest to you and straighten it out above the head. Then adjust the legs so they are nearly straight or bent only slightly at the knees.

Place one hand on the back of the victim's head and neck to prevent it from twisting.

With your second hand grasp the victim under his arm to brace the shoulder and torso. This will be the major point on the body where you'll exert the pull to roll the body over.

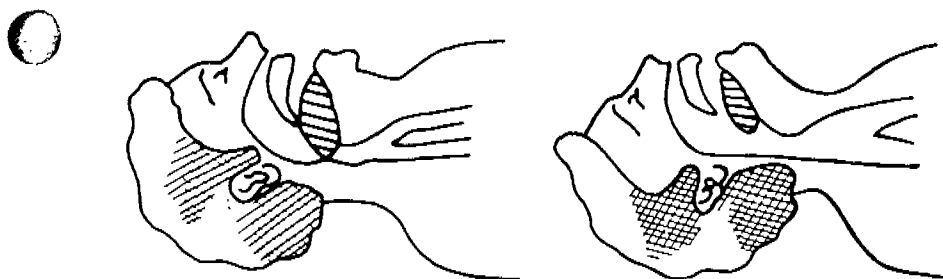
Pull steadily and evenly to move the weight without twisting the body. Pull evenly and carefully, and the torso and hips will follow the shoulders with minimal twisting.

Watch the head and neck.

Try to keep the body from twisting. (There may be neck or spinal injuries you don't want to complicate!)

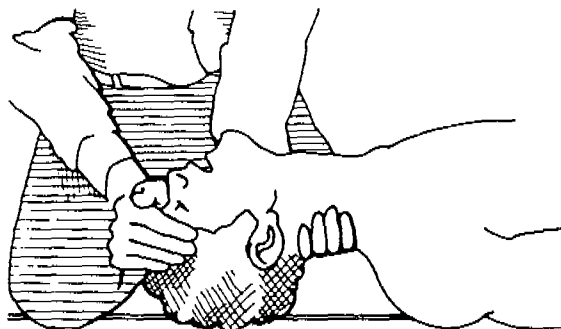
The victim should end up flat on his back, in position for you to begin CPR.

OPENING THE AIRWAY



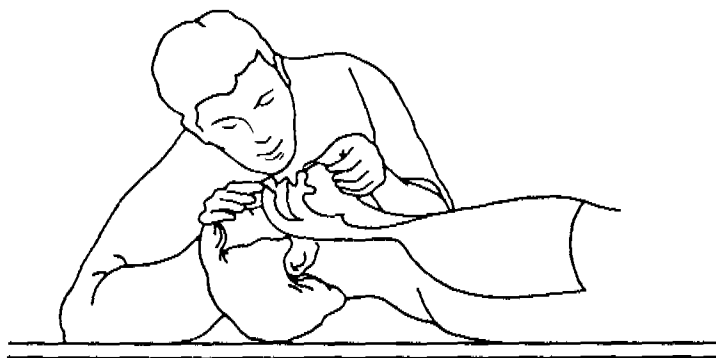
The most common cause of airway obstruction in the unconscious victim is the tongue. Since the tongue is attached to the lower jaw, moving the lower jaw forward lifts the tongue away from the back of the throat and opens the airway. As long as there is enough tone in the muscles of the jaw, tilting the head back will cause the lower jaw to move forward and open the airway.

HEAD TILT — NECK LIFT



Head tilt is accomplished while the rescuer is at the victim's side, placing one hand beneath the victim's neck and the other hand on the forehead. The rescuer then lifts the neck with one hand while tilting the head by backward pressure on the forehead. Excess force in performing this maneuver may cause cervical spine injury. Since the specific movement used is extension of the head at the junction of the head and neck rather than hyperextension of the cervical vertebrae, the hand lifting the neck should be placed close to the back of the head to minimize the cervical spine hyperextension. Emphasis should be placed on the need for gentleness when lifting the neck. If loose dentures are a problem they may be managed with Head Tilt - Chin Lift or may be removed.

HEAD TILT — CHIN LIFT

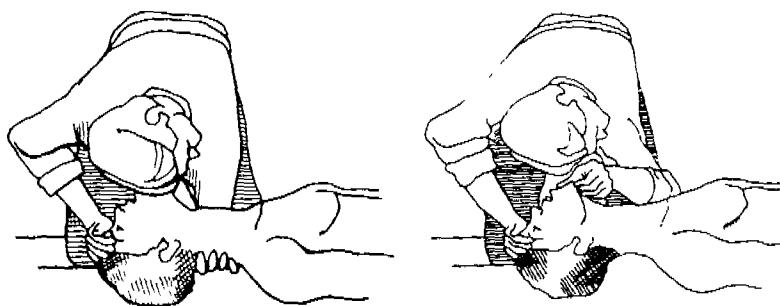


Negative pressure is created in a person's airway during inspiration. For an unconscious person making inspiratory effort, and thus creating negative pressure in the airway, his tongue, if close to the posterior wall of the pharynx, may act as a valve and occlude the airway during inspiratory effort. Even though the head is tilted back and the neck extended, the lower jaw sometimes needs support to adequately lift the tongue and provide an open airway. Frequently, due to Central Nervous System (CNS) depression, there is such profound relaxation of the muscles of the jaw that head tilt - neck lift alone is not enough to open the airway. Deep CNS depression can be caused by progressively severe lack of oxygen to the brain resulting from heart attack, lung disease, internal hemorrhage, drug overdose, electrocution, drowning or trauma. Support of the lower jaw may be accomplished by lifting the chin. The fingers of one hand are placed under the lower jaw on the bony part near the chin and lifted to bring the chin forward, supporting the jaw and helping to tilt the head back. The fingers must not compress the soft tissue under the chin which might obstruct the airway.

The other hand presses on the victim's forehead to tilt the head back. The thumb is used rarely when lifting the chin, and then only to lightly depress the lower lip . . . never for lifting the chin.

THE CHIN SHOULD BE LIFTED SO THAT THE TEETH ARE NEARLY BROUGHT TOGETHER. AVOID COMPLETELY CLOSING THE MOUTH. If the victim has loose dentures they can be held in position, making obstruction by the lips less likely. If rescue breathing is needed, the mouth-to-mouth seal is easier when dentures are in place. If dentures cannot be managed in place, remove them.

ESTABLISHING BREATHLESSNESS



When maintaining the open airway position, the rescuer places his ear over the victim's mouth and nose, looking toward the victim's chest and stomach.

LOOK for the chest to rise and fall.

LISTEN for air escaping during exhalation.

FEEL for the flow of air on your cheek.

JAW THRUST

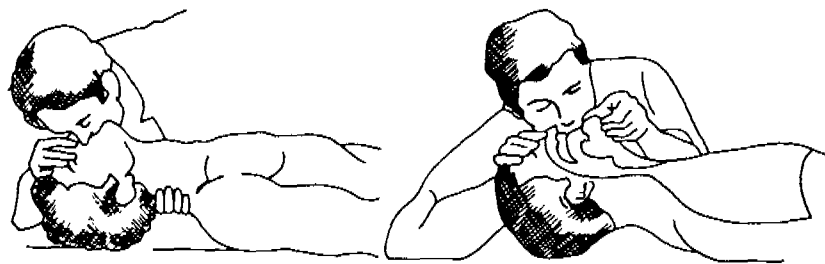


Additional forward displacement of the jaw -- jaw thrust -- may be required. This can be accomplished by the rescuer grasping the angles of the victim's lower jaw and lifting with both hands, one on each side, displacing the mandible forward while tilting the head backwards. The rescuer's elbows should rest on the surface on which the victim is lying. If the lips close, the lower lip can be retracted with the thumb. If mouth-to-mouth breathing is necessary, close the nostrils by placing your cheek tightly against them.

The jaw thrust technique is the safest first approach to opening the airway of a victim who has a suspected neck injury because in most cases it can be accomplished without extending the neck. The head can be carefully supported without tilting it backwards or turning it from side to side. If this is unsuccessful, the head should be tilted back very slightly and another attempt made to ventilate.

It should be stressed that, although the rescuer may notice that the victim is making respiratory efforts, the airway still may be obstructed. Many times opening the airway is all that is needed. If the victim resumes breathing, the airway is simply maintained. If the victim isn't breathing, apply rescue breathing.

RESCUE BREATHING



With the thumb and index finger of the hand that is on the forehead, the rescuer gently pinches the nostrils closed so that air won't escape. Then he takes a deep breath, opening his mouth very wide and placing it around the outside of the victim's mouth making a seal. He blows air into the victim's mouth. Out of the corner of his eye, the rescuer watches to see if the victim's chest is rising. If it is, the lungs are being ventilated.

Individual ventilation should be limited to that required to see the chest rise. In most adults this is usually a minimum volume of 800cc and adequate ventilation does not need to exceed 1200cc. Below 800cc, ventilation is probably inadequate. Breaths during rescue breathing and ventilations interposed during two person CPR need not exceed 1200cc.

Two liters should not be exceeded when giving the four quick full breaths at the beginning of rescue breathing and on the two ventilations following 15 chest compressions during one person CPR.

Volumes in excess of 2 litres are likely to be associated with pharyngeal pressure exceeding the esophageal pressure and result in air entering the stomach.

After delivering each breath, the rescuer quickly turns his head toward the victim's chest in order to take a breath of fresh air.

Initially give **FOUR QUICK FULL BREATHS** without allowing time for full lung deflation between breaths. Quickly take in a breath of fresh air between each ventilation. Throughout the time of giving the four breaths positive pressure is maintained in the airway. If breathing has stopped, even for a short time, some of the small air sacs of the lung collapse. These are more effectively filled and ventilated by maintaining positive pressure in the lungs during the four initial full breaths.

TWO QUICK FULL BREATHS, without allowing time for full lung deflation between breaths, are delivered after each cycle of 15 compressions in single rescuer CPR.

ONE BREATH EVERY FIVE SECONDS is performed either for nonbreathing victims with a pulse (rescue breathing alone), or during 2 rescuer CPR. During 2 rescuer CPR, the breath is interposed during the upstroke of the fifth chest compression.

PROBLEMS WHICH ARE ENCOUNTERED LEARNING MOUTH-TO-MOUTH RESCUE BREATHING:

- a. Rescuer not opening his own mouth wide enough. This results in an inadequate seal and causes air leaks.
- b. Applying too much pressure of the rescuer's mouth against the victim's mouth. This usually results in working too hard at making the seal. This seal can be made by the very lightest touch of the rescuer's mouth with the mouth of the victim. A bruise may appear on the lower lip of the student rescuer, indicating too much pressure being applied.
- c. The student rescuer with dentures may have difficulty with dentures coming loose. This problem can frequently be overcome by learning to make very light mouth-to-mouth contact, thereby avoiding pressure on the dentures and making them loose.

An occasional rescuer will find air going between the upper denture and the palate. If light contact with the victim's mouth does not solve the problem he may need to perform rescue breathing with his own tongue applying pressure against his upper denture. Removal of the rescuer's dentures is the last resort. Mouth-to-mouth contact is more difficult and some air leak is unavoidable, but adequate rescue breathing is possible.

- d. The nostrils are closed with the least effort when pinched right at the nasal openings.

MOUTH-TO-NOSE VENTILATION is more effective than mouth-to-mouth ventilation in some cases. The former is recommended when it is impossible to open the victim's mouth, when it is impossible to ventilate through his mouth, when the victim's mouth is seriously injured, and when it is difficult to achieve a tight seal around his mouth. For the mouth-to-nose technique, the rescuer keeps the victim's head tilted back with one hand on the forehead and uses the other hand to lift the victim's lower jaw and close the mouth. The rescuer then takes a deep breath, seals his lips around the victim's nose, and blows in until he feels the lungs expand.

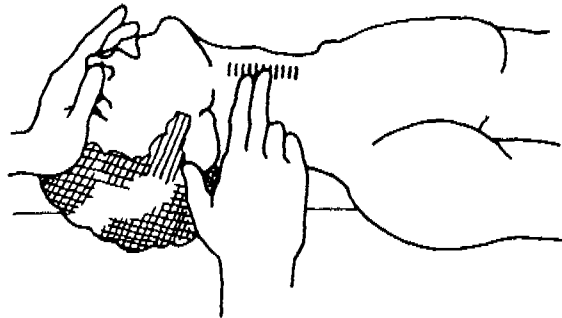
The rescuer removes his mouth, and the victim is allowed to exhale passively. The rescuer can see the chest fall when the victim exhales. When mouth-to-nose ventilation is used it may be necessary to open the victim's mouth or separate his lips to allow the air to escape during exhalation because the soft palate may cause nasopharyngeal obstruction and interfere with exhalation through the nose.

MOUTH-TO-STOMA artificial ventilation should be used for persons who have had a laryngectomy. They have a permanent stoma that connects their trachea directly to skin. It is recognized as an opening at the front of the base of the neck. For a patient

with a temporary tracheostomy tube in his airway, it is usually necessary for the rescuer to seal the victim's mouth and nose with his hand or a tightly fitting face mask to prevent leakage of air when the rescuer blows into the tracheostomy tube. This problem can be prevented if the tracheostomy tube is provided with an inflatable cuff.

No adjuncts are required for effective rescue breathing, so artificial ventilation should never be delayed to obtain or apply adjunctive devices.

ESTABLISHING PRESENCE OR ABSENCE OF PULSE



In a real-life situation, finding no pulse makes the diagnosis of cardiac arrest.

A. Why the neck pulse?

1. Most accessible
2. Most reliable
3. Most easily learned and remembered

B. Method

When the rescuer is kneeling at the victim's side the hand is left on the forehead to maintain head position and the other hand is used to palpate the carotid pulse. The pulse is felt on the side of the victim's neck nearest to the rescuer.

The rescuer puts the tips of his fingers gently on the windpipe, then slides the fingers to the side nearest him, gently pressing the soft part of the neck next to the windpipe. If there is a pulse, it can be felt this way.

Note: the neck or carotid pulse lies in a groove created by the windpipe and the large strap muscles of the neck. The pulse should be felt on the side nearest to the rescuer because:

1. There is a tendency for the windpipe to support the palpating fingers, interfering with feeling the pulse if felt for on the far side of the rescuer.
2. There is a tendency for students to become heavy handed feeling for the pulse on the away side - pressing down on the windpipe and impairing the airway both with pressure on the airway and reversing the proper head tilt position.
3. There is a tendency to feel with the fingers on the far side and the thumb on the near side. Do not feel for neck pulses on both sides at the same time.

ACTIVATE EMS SYSTEM

If the rescuer is not alone, one person should be sent to call the emergency telephone number to activate the emergency system.



The shorter the time interval between collapse and initiation of basic CPR and ACLS, the more likely will be the survival of the cardiac arrest victim. If the rescuer is alone, he may perform CPR for one minute and then quickly telephone for help. The decision as to when to telephone for help is affected by a number of variables, including the possibility of someone else arriving on the scene.

If no telephone is available, the only option is for the rescuer to continue CPR.

MOUTH-TO-MOUTH BREATHING IN ONE RESCUER CPR

If the pulse is present, the rescuer continues to perform rescue breathing, ventilating the lungs once every five seconds until help arrives. He should recheck continued presence of the pulse after each 12 ventilations (or 1 minute).

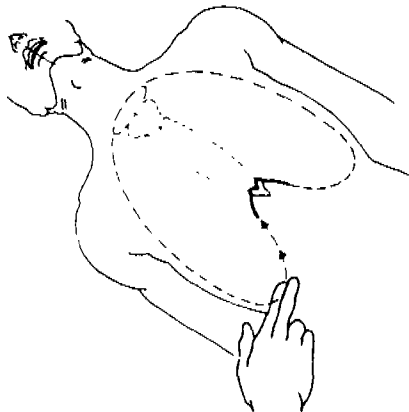
If the rescuer can't feel a pulse, he is going to have to circulate the blood as well as breathe for the victim. This is done by applying external heart compression.

EXTERNAL CHEST COMPRESSION

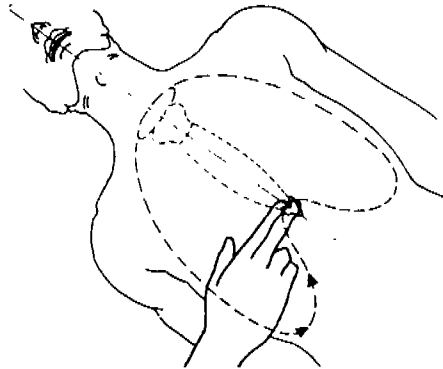
The victim always must be in the horizontal position when external heart compression is performed. During heart arrest, even during properly performed external heart compression, there is inadequate blood flow to the brain when the body is in an upright position.



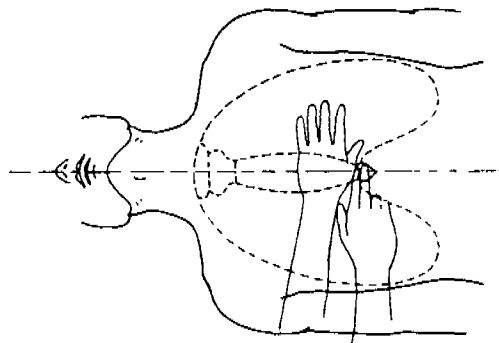
1. With the middle and index fingers of the lower hand the rescuer locates the lower margin of the victim's rib cage on the side next to the rescuer.



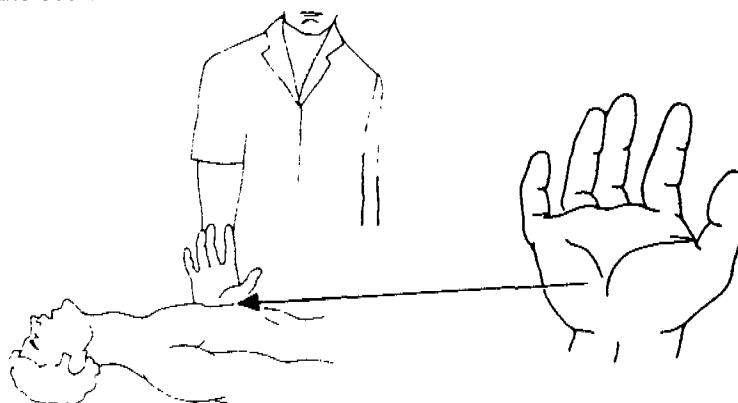
2. The fingers are then run along the rib cage to the notch where the ribs meet the sternum in the center of the lower chest.



3. With the middle finger on the notch, the index finger is placed next to the middle finger on the lower end of the sternum. (Note that the location of the xiphoid is irrelevant if this technique is utilized.)



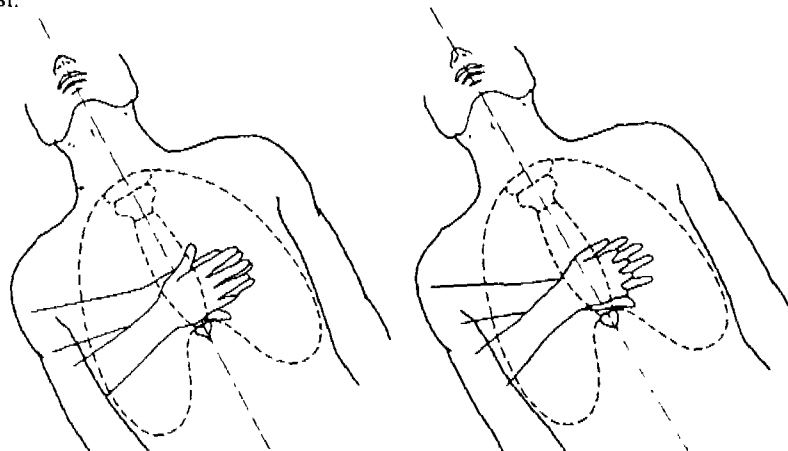
4. The heel of the other hand (which had been used on the forehead to maintain head position) is placed on the lower half of the sternum, and just next to the index finger which is next to the middle finger that located the notch. The long axis of the heel of your hand should be placed on the long axis of the breastbone. This will keep the main line of force of compression on the breastbone and decrease the chance of rib fracture.



5. This first hand is then removed from the notch, placed on top of the hand on the sternum so that both hands are parallel and directed straight away from the rescuer. (Alternate methods of locating the correct pressure point are acceptable if they accomplish the same hand position on the chest.)



6. The fingers may be either extended or interlaced but must be kept off the chest.

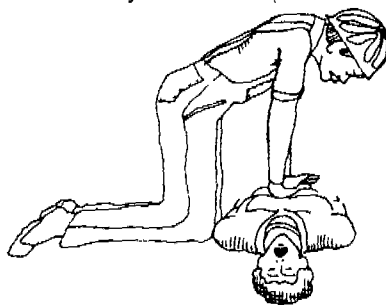


7. Because of varying size and shape of different people's hands, an alternate acceptable hand position is grasping the wrist of the hand on the chest with the hand which has been locating the lower end of the breastbone. This technique is helpful for those rescuers with arthritic problems of the hand and wrist.

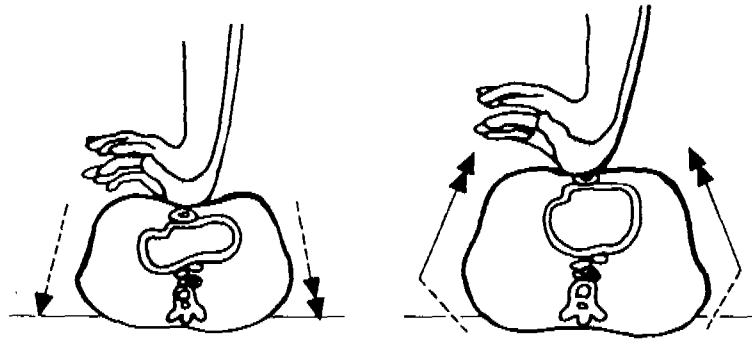
8. The elbows are straightened by locking them, and the rescuer positions his shoulders directly over his hands so that the thrust for external heart compression is straight down. If the thrust is other than straight down the torso has a tendency to roll, part of the effort is lost, the chest compression is less effective and requires an inefficient amount of effort from the rescuer.



9. To achieve the most pressure with the least effort, lean forward until your shoulders are directly over your outstretched hands. That is, lean forward until your body reaches a point of natural imbalance . . . at this point you feel like you would fall forward if your hands and arms were not supporting you. The weight of your back creates the necessary pressure when your body is off balance this way; and it's much easier on your arms and shoulders. The shoulders of the rescuer should be directly over the breastbone of the victim.



10. To compress the sternum of a normal sized adult you must push with enough force to depress the sternum $1\frac{1}{2}$ to 2". With each compression you want to squeeze the heart or increase the pressure within the chest so that blood moves through the body. Then you must release the pressure to allow the heart and lungs to refill. You must compress in this manner at a rate of 80 times per minute in one rescuer CPR.



11. If you use the weight of your upper body this way, you do not depend on the strength of your arms and shoulders as much. Instead of having to push from your shoulders, you let the natural weight of your body falling forward provide the force to depress the victim's sternum. Keep the arms straight.
12. Do not push with all your strength . . . but push with just enough force to depress the sternum $1\frac{1}{2}$ -2 inches. This is about as far as it will comfortably go. This may compress the heart between the breastbone and the spine and force blood out of the heart for circulation to vital organs of the body. Blood circulated to the lungs will pick up oxygen necessary to maintain life. Recently it has been recognized that many persons suffering cardiac arrest and undergoing proper cardiopulmonary resuscitation will not have their heart compressed between the breastbone and spine. Nonetheless cardiopulmonary resuscitation as presently performed is effective in circulating blood to the brain and other vital organs as a result of a generalized increasing pressure within the chest cavity. Because of certain unique properties of the arteries and veins of the body, this pressure within the chest cavity is transmitted into the arteries outside the chest to a greater extent than into the veins outside the chest. With the arterial pressure outside the chest being higher than the venous pressure such as the brain.
13. Then you must release this pressure to allow blood to flow into the heart and lungs. If the heart and lungs cannot refill, there will be no blood to carry oxygen throughout the body on the next compression. Therefore, release the pressure completely and allow the chest to return to its normal position. The time allowed for release should be equal to the time required for compression. Do not pause between compression.
14. Do not lift your hands off the chest, or change their position in any way, because correct hand position may be lost. Bouncing compressions must be avoided since they are less effective and are more likely to cause injury.

15 COMPRESSIONS ALTERNATING WITH TWO VENTILATIONS

ONE RESCUER CPR



1. Perform 15 cardiac compressions at a rate of 80 per minute. Count one and, two and, three and, four and, five and, six and, seven and, eight and, nine and, ten and, eleven and, twelve and, thirteen and, fourteen and, fifteen. ALTERNATE METHODS OF COUNTING ARE PERMISSIBLE AS LONG AS THE CORRECT NUMBER OF COMPRESSIONS (15) ARE ACHIEVED WITHIN THE TIME ALLOWED.
2. Move up to head, lean over quickly open the airway again. Take a deep breath, seal the nose, and deliver two quick full breaths.
3. Move back to the chest, locate proper hand position and begin 15 compressions at a rate of 80 per minute again.
4. Repeat the above cycle four times.

CHECKING FOR RETURN OF PULSE OR BREATHING AFTER FIRST MINUTE

1. After delivering the two quick, full breaths of the last cycle, place your ears over the victim's mouth and nose, looking toward the victim's chest and stomach and look, listen and feel to determine whether spontaneous breathing has resumed.
2. Leaving the hand on the forehead to maintain head position, palpate the carotid with the other hand to determine if spontaneous heartbeat has returned.
3. It is optional whether eye pupils are checked. This is of limited value and not always a sure sign of the victim's condition because of a number of factors.



RESUME CPR

1. If breathing and pulse are still absent, resume single rescuer CPR.
2. If single rescuer CPR is continued, stop and check for return of spontaneous breathing and pulse every 4-5 minutes thereafter.

You know that artificial circulation is not as effective as normal healthy circulation. With each compression you must maintain adequate blood flow; then you must release the pressure and allow the heart to refill after each compression. Any interruption in compression results in a drop in blood flow to zero.

NEVER INTERRUPT CPR FOR MORE THAN FIVE SECONDS. (Except in Special Circumstances.)

TWO RESCUER CPR

When a second rescuer becomes available he or she ideally takes over ventilation.

In real situations the second rescuer assists as soon as available. When testing students, the second rescuer enters following the check for the return of pulse and spontaneous breathing after one minute of single rescuer CPR. The first rescuer should resume one rescuer CPR.

As a second rescuer arrives, he should identify himself as a trained rescuer and let the first rescuer know that he is willing to help. Without stopping CPR, the single rescuer lets the second rescuer know that he wants him to assist and is ready to switch over to two rescuer CPR.

Now the second rescuer will need to check the victim's pulse himself, in order to assure himself that the first rescuer has correctly interpreted the victim's condition. He kneels down on the opposite side of the victim from the first rescuer, in position for rescue breathing, with his fingers in position to feel the victim's carotid pulse. After he can feel a pulse with each compression, he calls out "Stop compression." The first rescuer stops compressing for five seconds, so that the second rescuer can check if the victim has a spontaneous pulse or if breathing has returned. If no pulse or breathing is found, the second rescuer should inform the first rescuer of his findings and the rescuers are ready to begin two rescuer CPR immediately.

The second rescuer should interpose a breath immediately after establishing pulselessness. The first rescuer changes from a rate of 80 to 60 compressions per minute and changes to the slower mnemonic (one-one thousand, two-one thousand, three-one thousand, four-one thousand, five-one thousand, one-one thousand).

The rescue breathing is then interposed during the upstroke of each 5th chest compression.

The student should learn:

- a. That mouth-to-mouth positioning should occur at the end of the 4th compression.
- b. That the airway should be "pressurized" during the 5th downstroke. This does not mean moving air but it does mean applying gentle pressure so that the breath may be quickly interposed during the upstroke of the fifth compression. It is sometimes helpful to ask the student to think of lifting the compressor's hands with his ventilation during the fifth upstroke.

The chest compressor should be counting out loudly and clearly, "one-one thousand, two-one thousand, three-one thousand, four-one thousand, five-one thousand." There should be no pause or hesitation following the fifth compression prior to the first compression of the next cycle of five. Other mnemonics which accomplish the same purpose are acceptable for certification.

The ventilator should feel for the carotid pulse frequently during chest compression to assess the effectiveness of compression. If the pulse is inadequate, the ventilator should tell the compressor to compress harder. Ventilation and compression should be interrupted to check for the return of spontaneous breathing and pulse every few minutes. A logical time to do this would be at the time of the switch in position of the rescuers. If they switch more frequently than every two minutes, it is not necessary to check during every switch.

TWO RESCUER CHANGE OF POSITION

CPR can be performed more smoothly and effectively when the two rescuers are on the opposite sides of the victim. They can then switch positions when necessary without serious interruption in the 5:1 sequence. The switch is initiated when the rescuer who is performing compressions states that a switch take place at the end of a 5:1 sequence. The chest compressor, instead of saying "one-one thousand, two-one thousand, three-one thousand, four-one thousand, five-one thousand," says instead, "change one thousand, two-one thousand, three-one thousand, four-one thousand, five-one thousand."

(Any mnemonic which accomplishes this purpose is acceptable.) The rescuer who is performing the ventilations, after giving a breath, moves into position to give compressions. The rescuer giving compressions, after giving the fifth compression, moves to the victim's head and checks the pulse for 5 seconds but no longer. If no pulse is felt, the rescuer at the head gives a breath and tells the rescuer at the chest to "continue CPR". If there is a pulse but no breathing, he should say there is a pulse and give artificial ventilation.

GASTRIC DISTENTION

Artificial ventilation frequently causes distension of the stomach. This occurs most often in children but it is not uncommon in adults. It is most likely to occur when excessive pressures are used for inflation of if the airway is partially or completely obstructed. The incidence of gastric distention can be minimized by limiting ventilation volumes to that point at which the chest rises, thereby avoiding exceeding esophageal opening pressures.

Marked distention of the stomach may be dangerous because it promotes regurgitation and reduces lung volume by elevation of the diaphragm. If the stomach becomes distended during rescue breathing, recheck and reposition the airway, observe the rise and fall of the chest, and avoid excessive airway pressure. Continue rescue breathing without attempting to expel the stomach contents. Experience in the field has shown that attempting to relieve stomach distention by manual pressure over the victim's upper abdomen is an almost sure way to cause him to regurgitate. Where suctioning equipment is not available, aspiration of stomach contents into the lungs may occur. If regurgitation does occur, turn the victim's entire body on the side, wipe out mouth, and continue CPR.

If severe gastric distention results in inadequate ventilation by elevating the

diaphragm and it cannot be corrected by repositioning the airway, pressure over the epigastrium (after placing the victim on his side) to expel the air from the stomach may be necessary despite the risk of inducing regurgitation and aspiration.

MANAGEMENT OF THE OBSTRUCTED AIRWAY

FOREIGN BODY AIRWAY OBSTRUCTION

Upper airway obstruction can cause unconsciousness and cardiopulmonary arrest, but far more often upper airway obstruction is caused by unconsciousness and cardiopulmonary arrest.

Management of upper airway obstruction should be taught within the context of basic life support. The leading cause of cardiopulmonary arrest is coronary heart disease and this accounts for more than 650,000 deaths annually. Foreign body obstruction of the airway accounted for approximately 2,900 deaths in 1978 according to the National Safety Council.

Foreign body obstruction of the airway usually occurs during eating. In adults, meat is the most common cause of obstruction, although a variety of other foods and foreign bodies have been the cause of choking in children and some adults. Common factors associated with choking on food include: (1) large, poorly-chewed pieces of food; (2) elevated blood alcohol; (3) upper and/or lower dentures. This emergency has been mistaken for a heart attack, giving rise to the name "cafe coronary."²⁸

The following precautions are recommended to avoid airway obstruction: (1) cut food into small pieces, chew slowly and thoroughly, especially if wearing dentures; (2) avoid laughing and talking during chewing and swallowing; (3) avoid excessive intake of alcohol before and during meals; (4) restrict children from walking, running or playing with food or foreign bodies in their mouths; (5) keep foreign objects, i.e., marbles, beads, thumbtacks, away from infants and small children.

An unconscious patient can develop airway obstruction because the tongue falls back into the pharynx, obstructing the upper airway. Regurgitation of stomach contents into the pharynx can occur during a cardiopulmonary arrest or during resuscitative attempts. Head and facial injuries may result in blood clots obstructing the upper airway, particularly if the patient is unconscious.

RECOGNITION OF FOREIGN BODY OBSTRUCTION

Because early recognition of airway obstruction is the key to successful management, it is important to differentiate this emergency from fainting, stroke, heart attack, epilepsy, drug overdose, or other conditions which cause sudden respiratory failure and which are managed differently.

Foreign bodies may cause either partial airway obstruction or complete airway obstruction. With partial airway obstruction, the victim may be capable of either "good

air exchange" or "poor air exchange." With good air exchange, the victim can cough forcefully, although frequently there is wheezing between the coughs. As long as good air exchange continues, the victim should be allowed and encouraged to persist with spontaneous coughing and breathing efforts. At this point, do not interfere with his attempts to expel the foreign body.

Poor air exchange may occur initially, or good air exchange may progress to poor air exchange, as indicated by a weak, ineffective cough, high-pitched noises while inhaling (such as crowing-like noise), increased respiratory difficulty, and possibly cyanosis (bluish color of skin, fingernail beds, and inside mouth). At this point manage the partial obstruction as though it were a complete airway obstruction.

With complete airway obstruction the victim is unable to speak, breathe, or cough. He may clutch his neck (universal distress signal). Movement of air will be absent and prompt action is required. The oxygen in the lungs is depleted because the obstructed airway prevents entry of air into the lungs, the brain develops oxygen lack and unconsciousness will occur and death will follow rapidly.

MANAGEMENT OF THE OBSTRUCTED AIRWAY

Manual Maneuvers

Three manual maneuvers are recommended for relieving foreign body airway obstruction: back blows, manual thrusts, and finger sweep.

The following provides a description of each maneuver with the recommended position and method of application.

I. Back Blows

These consist of a rapid series of four sharp blows delivered with the heel of the hand over the spine and between the shoulder blades, and serve as a part of the mechanism to dislodge a foreign body.

Back blows may be administered with the victim sitting, standing or lying, and should be applied forcefully, in rapid succession. Each back blow should be delivered with the intent of relieving the obstruction without having to complete the full series

Victim Standing or Sitting

1. Position yourself at the side and slightly behind the victim.
2. Place your other hand on the chest to support him.
3. Deliver four sharp blows with the heel of your hand over the victim's spine between the shoulder blades.

Whenever possible, the victim's head should be lower than his chest to make use of the effect of gravity.

Victim Lying

1. Kneel and roll the victim onto his side, facing you, with his chest against your thigh.
2. Deliver four sharp blows to the back as described above.

II. Manual Thrusts

Manual Thrusts consist of a rapid series of four thrusts to the upper abdomen (abdominal thrust) or lower chest (chest thrust) that force air out of the lungs creating an artificial cough intended to move the foreign body. Each thrust should be delivered with the intent of relieving the obstruction without having to complete the full series.

A. Abdominal Thrust

Victim Standing or Sitting

1. Stand behind the victim and wrap your arms around his/her waist.
2. Grasp one fist with your other hand, and place the thumb side of your fist against the victim's abdomen, in the midline between the waist and the ribcage.
3. Press your fist four times into the victim's abdomen with a quick inward and upward thrust.

Victim Lying

1. Position the victim lying on his back with your knees close to his hips. Open the airway and turn head up.
2. Place the heel of one hand against the victim's abdomen, in the midline between the waist and the ribcage.
3. Move forward so that your shoulders are directly over the victim's abdomen.

4. Position of Rescuer

(Two positions of the rescuer are described. The rescuer may do this maneuver in either position.)

- a. Rescuer astride victim. In this position the rescuer straddles the hips or one thigh of the supine victim.
- b. The rescuer alongside the victim. In this position the rescuer's knees are close to the victim's hips on either the right or the left side of the victim.

5. Press into the victim's abdomen with a quick inward and upward thrust. Do not press to either side.

Victim Alone

The victim who is alone can perform the maneuver on him/herself in the following manner: Press a fist into the upper abdomen with a quick upward thrust as described for the victim standing, or lean forward and press the abdomen quickly over any firm object such as the back of a chair, table or porch railing.

B. Chest Thrust

As an alternate technique to the abdominal thrust, this maneuver may be applied to the chest. It is particularly useful when the abdominal girth is so large the rescuer cannot fully wrap his arms around the victim's abdomen as with gross obesity, or when pressure applied directly to the victim's abdomen is likely to cause complications, as in advanced pregnancy.

Victim Standing or Sitting

1. Stand behind the victim, place your arms directly under the victim's armpits, and encircle the victim's chest.
2. Place the thumb side of your fist on middle of the breastbone, but not on the xiphoid process or the margins of the rib cage.
3. Grasp your fist with your other hand and exert four quick backward thrusts.

Victim Lying

1. Place the victim on his back and kneel close to the side of his body. Open the airway and turn head to one side.

2. Hand position for an application of chest thrust is the same as that for applying closed chest heart compression. (Heel of hand on lower half of sternum.)
3. Exert four quick downward thrusts that will compress the chest cavity.

Combined Use of Back Blows and Manual Thrusts

Back blows produce an instantaneous increase in pressure in the respiratory passages, which may result in either partial or complete dislodgement of a foreign body. The manual thrusts produce a more sustained increase in pressure in the respiratory passages and may further assist in the dislodgement and movement of the foreign body. The combination of these two techniques appears to be the most effective method of clearing upper airway obstruction, rather than isolated use of one technique. The only comparative data in the medical literature shows that the combination of back blows and thrusts is superior to either method when used alone. It also sheds no light on the most effective sequence. Therefore the sequence of thrusts followed by back blows could represent an acceptable alternative to the recommended sequence of back blows followed by thrusts.

Manual Removal of Foreign Bodies

If the presence of a foreign body is strongly suspected or can be seen in the mouth, it should be removed with the fingers. If it cannot be seen, the combination of back blows and manual thrusts may expel it or dislodge it so that it is more accessible for removal by the fingers.

It is difficult to remove foreign bodies from the airway with your fingers, and, in most cases, it is impossible to open the victim's mouth and insert your fingers for this purpose unless he or she is unconscious. In some cases, especially with infants and small children, an adult's finger may force a foreign body deeper into the throat and cause complete airway obstruction. However, large foreign bodies can sometimes be dislodged and removed if they are at the level of or above the epiglottis.

C. Finger Sweep

1. With the head up, open the victim's mouth by grasping both the tongue and lower jaw between your thumb and fingers and lifting ("tongue-jaw lift"). This action draws the tongue away from the back of the throat and away from a foreign body that

may be lodged there. This along may partially relieve the obstruction. If you are unable to open the mouth with the "tongue-jaw lift" technique, use the crossed-finger technique to open the airway. Open the mouth by crossing your finger and thumb and push the teeth apart.

2. Insert the index finger of your other hand down along the inside of the cheek and deeply into the throat to the base of the tongue. Then use a hooking action to dislodge the foreign body and maneuver it into the mouth so it can be removed. Sometimes it is necessary to use the index finger to push the foreign body against the opposite side of the throat to dislodge and lift it. Be careful not to force the object deeper into the airway. If the foreign body comes within reach, grasp and remove it.

III. Devices

The following devices are recommended for use in relieving foreign body airway obstruction. THE USE OF THESE DEVICES IS RESTRICTED TO THOSE PROPERLY TRAINED IN THEIR USE AND APPLICATION.

- Two types of conventional forceps: Kelly clamp and Magill forceps. Forceps should be used only with direct visualization of the foreign body. Either a laryngoscope or tongue blade and flashlight can be used to permit direct visualization.
- Devices for performing cricothyroid membrane puncture.

SEQUENCING OF PROCEDURES FOR EMERGENCY RELIEF OF FOREIGN BODY AIRWAY OBSTRUCTION

The recommended sequence of procedures for emergency relief of airway obstruction varies according to: (1) whether the emergency involves a conscious victim suspected of having a complete obstruction of the airway, an obvious choking victim who has been treated and who becomes unconscious or an unwitnessed unconscious victim; and (2) the degree of training of the rescuer, whether he is part of the lay public or trained in more advanced emergency medical care procedures.

Note: In following the sequence of procedures, the procedures are determined ineffective if, after their application, the victim does not do at least one of the following: 1) resume spontaneous breathing; 2) regain consciousness; 3) begin to regain normal coloring of skin; 4) expel the foreign body from the mouth or into the mouth where it can be seen. The procedures are effective if, after their application, the victim does at least one of the above.

If at any stage a foreign body is seen in the mouth, attempt to remove it by finger sweeps.

Conscious Victim

In the conscious victim of foreign body airway obstruction, immediate recognition and proper action are essential. If the victim has good air exchange with only partial obstruction and is still able to speak or cough effectively, do not interfere with his or her attempts to expel a foreign body.

The following sequence of maneuvers should be performed on the conscious victim:

1. Identify complete airway obstruction by asking victim if he is able to speak.
2. Four Back Blows in rapid succession.
3. Four Manual Thrusts.
4. Repeat four back blows and four manual thrusts until they are effective or until the victim becomes unconscious.

If the victim becomes unconscious, follow the sequence of maneuvers described below.

Choking Victim Who Becomes Unconscious

The rescuer should call for help, open the airway and attempt to ventilate. If he is unsuccessful at ventilation, he should quickly perform the following:

1. If a second person is available, he should activate the EMS System.
2. Apply 4 back blows in rapid succession.
3. Apply 4 manual thrusts.
4. Apply the finger sweep. Dentures may need to be removed to improve the finger sweep.
5. Reposition the head, open the airway and attempt to ventilate. If the victim cannot be ventilated
6. Repeat steps 2, 3, 4, and 5 until successful or ACLS is available.

Unconscious Victim and the Cause is Not Known

If the rescuer has found an unconscious victim, called for help, opened the airway, established breathlessness, attempted to ventilate and cannot,

quickly perform the following sequence:

1. Reposition the head. Try again to ventilate. If unsuccessful and a second person is available, he should activate the EMS System.
2. Four Back Blows in rapid succession.
3. Four Manual Thrusts.
4. Finger Sweep. May need to remove dentures to improve finger sweep.
5. Reposition the head and attempt to ventilate. If victim cannot be ventilated . . .
6. Repeat steps 2, 3, 4, and 5 until successful or ACLS is available.

If successful in removing the foreign body, perform mouth-to-mouth ventilation or cardiopulmonary resuscitation if necessary. If the victim begins spontaneous respiration, further examination by a physician is recommended.

- NOTE:
- 1) As the victim becomes more deprived of oxygen (anoxic), the muscles will relax, and maneuvers that were previously ineffective may become effective.
 - 2) When the muscles relax or a foreign body is partially dislodged and the airway is partially open, slow, full, and forceful ventilation may keep a victim alive while bypassing the obstruction.
 - 3) If there is vomitus in the mouth or throat, turn the head and body to the side, wipe material out quickly, and proceed with the sequence.

COMMENTS

Abdominal Thrusts/Chest Thrusts

There are no significant differences in the airway flow, pressure, and volume between abdominal and chest thrusts. The chest thrust is preferred for special circumstances, i.e., pregnancy, or marked obesity.

A significant consideration in either abdominal or chest thrust is possible damage to internal organs, such as rupture or laceration of abdominal or thoracic viscera. The rescuer's hands should never be placed on the xiphoid process of the sternum, or on the lower margins of the rib cage. They should be below this area for abdominal thrust and above this area for chest thrust. Use of the abdominal thrust instead of the chest thrust in the older age might avoid the fracture of brittle ribs. Regurgitation may occur as a result of abdominal thrust.

Training and proper performance should minimize these problems.

Unconscious Supine (face up) Victim - Side Position/Astride Position of Rescuer

One position for the rescuer to perform manual thrusts is at the side of the unconscious victim. At his side, the rescuer has more maneuverability, and is in position to perform many procedures, including chest thrusts, abdominal thrusts, back blows, turning the entire body if regurgitation occurs, finger sweeps, head tilt to open the airway and mouth-to-mouth ventilation. Of these only the abdominal thrust can be performed while astride the victim. If the rescuer is astride the victim, he has a natural midabdominal position and is thus unlikely to direct the thrust to the right or left, which could result in liver or spleen damage. While a small rescuer astride a large victim can use his weight to assure an effective abdominal thrust in the proper direction toward the diaphragm, proper hand and body position by a rescuer at the side can also provide for an effective thrust.

Other

The general public should be taught and encouraged to use the "distress signal or choking," clutching the neck between the thumb and index finger.

CHAPTER XI

BASIC LIFE SUPPORT IN INFANTS AND CHILDREN

Introduction:

Death rates have declined significantly during this century, and nowhere is this more true than in children. Today these chances are vastly improved and a child born today has a 98% chance of growing to adulthood. The death of a child - a commonplace event of yesteryear - has become the exception today. Nevertheless children do die. The transition from the womb to the outside world is a hazardous journey whose success depends on many adaptive mechanisms. It is not surprising then that the perinatal period should also be a time when CPR is probably more commonly used than at any other period of life. Fortunately in this country most births occur in a hospital setting. The CPR is performed by medical or nursing personnel and belongs in the Advanced Life Support. Occasionally, however, an infant is born in an unexpected place and at an unexpected time. A knowledge of BLS for infants will assure such a baby the best chance for survival. Having passed this dangerous period of life, the chances of sudden death decline and the number of children who might require resuscitation is small. Nevertheless, an examination of the statistics will indicate that the major cause of death in this age group is accidents which by their nature are sudden events, requiring immediate action. A knowledge of CPR for the infant and child and how this differs from that in the adult is therefore essential.

The basic principles of CPR are the same whether the victim is an infant, child, or adult. These principles include:

1. Establishing unresponsiveness or respiratory difficulty;
2. Calling for help;
3. Positioning the victim;
4. Airway: (a) Opening the airway; (b) Establishing breathlessness;
5. Breathing for the victim: (a) Rescue breathing; (b) Recognizing and managing the obstructed airway;
6. Circulation: (a) Establishing the presence or absence of pulse; (b) Activating the EMS system; (c) External chest compression.

The differences in CPR in the infant and child are in priorities and techniques to allow for different underlying causes of the emergencies in infants and children and for variation in size.

Causes of Cardiopulmonary Arrest in Infants and Children. -- Cardiopulmonary arrest from primary cardiac causes and rhythm disturbances is rare in infants and children. In the majority of instances, infants and children will have primary respiratory arrest with cardiac arrest a result of the ensuing hypoxia. Great attention, therefore, must be paid to patency of the airway and adequacy of ventilation. In many instances, further resuscitative attempts will prove unnecessary.

The major events that may necessitate resuscitation are the following: (1) suffocation caused by foreign bodies, e.g., toys, peanuts, plastic covers; (2) near drowning; (3) automobile or other accidents; (4) poisoning and drug overdose; (5) smoke inhalation; (6) sudden infant death syndrome (SIDS); (7) infection of the airway, i.e., croup, epiglottitis.

The vast majority of emergency situations requiring CPR are preventable, and special attention must therefore be paid to producing an environment for the child that is safe and protective without suppressing the child's intellectual curiosity and need for exploration and discovery. Children should be taught respect for matches and fires and, if too young, should not be left unsupervised. Toys should be carefully examined for small parts, which could be potentially aspirated, before being given to toddlers whose mouths are favorite receptacles. Beads, small plastic toys, marbles, and peanuts must be kept away from infants and preschoolers. Children should be taught to sit while eating and not be allowed to eat while running and playing. When in automobiles, appropriate infant seats and seat belts should be worn; and when old enough children should be taught water safety rules. Even the best performed CPR is worse than the prevention of the cause leading to its need.

Size of the Infant or Child. -- Children differ in size from infancy through adolescence. For the purpose of CPR, we have called anyone younger than one year an infant and between one and eight years a child. Techniques appropriate to the adult may be applied to children older than eight years of age. It is recognized that there are large infants (younger than one year of age) who might be mistaken for a child (one to eight years), while at the other end, a small adolescent might be mistaken for a child. These definitions should be taken as guidelines only. At the time of an emergency, one should not try to be too exact about age since a slight error one way or the other is not critical.

ESTABLISHING UNRESPONSIVENESS OR RESPIRATORY DIFFICULTY

An unconscious infant or child, like an adult, will not awaken or cry when shaken. The extremities will be limp. Therefore, to determine if an infant or child is unconscious, he should be gently tapped or shaken. If conscious, he will begin to move and cry. If a child is not unconscious but is gasping and struggling to breathe, he may need to have his airway opened and, if necessary, have rescue breathing coordinated to his breathing. As previously noted, the need for rescue breathing alone is more commonly required in infants and children than in adults.

Positioning the Victim. -- The circumstances in which the child victim is found will determine to some degree the care that must be exercised in positioning him. The likelihood of neck, spine, or bone injuries will be greater if the victim is found at the scene of an accident or at the base of a tree than if an infant is found in bed not breathing. If the infant or child is face down, he must be rolled over as a unit. One hand should always support the head and neck so that it does not roll or twist.

THE AIRWAY

Opening the Airway. -- Once it has been established that the infant or child is unconscious or is having serious difficulty breathing, the airway should be opened. An infant or child who is struggling to breathe but whose color is not blue probably has an adequate airway and is best immediately transported by the rescuer to an advanced life support facility. The infant or child who is not breathing or is making breathing efforts but is blue should have the airway opened. This is best done by the head tilt-neck lift technique or the head tilt augmented by the chin lift.

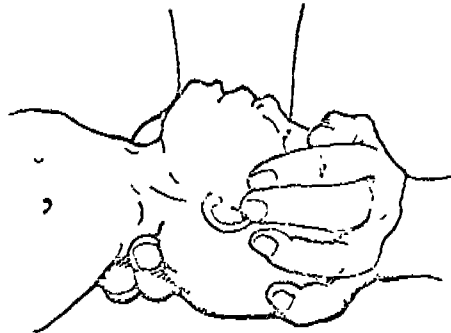


Fig. 1. Neck Lift

The head tilt-neck lift technique is performed by placing one hand (or as many fingers as will fit comfortably) under the victim's neck and the other hand on the forehead (Fig. 1.). The neck is lifted slightly and the head pushed back with gentle pressure on the forehead. This extension of the head will usually be sufficient to move the tongue away so it does not obstruct the airway. In some situations, the chin lift technique may be helpful in moving the tongue forward and away from the posterior pharyngeal wall. In this technique, extension of the head is maintained by pressure on the forehead.

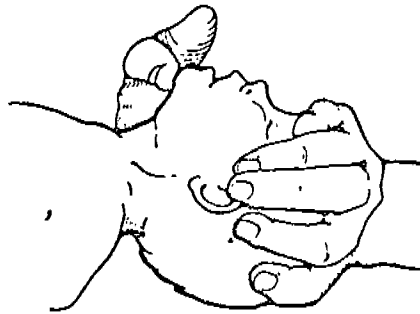


Fig. 2. Chin Lift

The tips of the fingers of the hand that had been under the neck are now used to lift the bony part of the jaw near the chin forward (Fig. 2.). Care should be exercised that the mouth is not closed completely and that the fingers are not causing undue pressure on the soft tissue under the jaw.

Establishing Breathlessness. -- As soon as the airway is opened and while it is maintained, the rescuer should immediately check whether the victim is breathing. The rescuer places his ear over the victim's mouth and nose and looks toward the victim's chest and abdomen. The victim is breathing if the rescuer (1) sees the chest and abdomen rise and fall, (2) feels air from the mouth and nose, and (3) hears air during exhalation.

It should be stressed that the airway may be obstructed despite respiratory efforts by the victim. Often, opening the airway is all the victim needs in order to breathe effectively. If the victim resumes breathing, the airway is simply maintained. If the victim is not breathing, rescue breathing is applied. If after opening the airway the infant or child is gasping or struggling to catch his breath, a decision has to be made by the rescuer whether to apply rescue breathing. This decision can be made by looking for blueness of the lips (the lips themselves, not the skin surrounding the lips), which is a sign of oxygen lack. If the lips are pink, enough oxygen is reaching the blood, and rescue breathing should not be attempted; instead, the victim should be transported as rapidly as possible to an advanced life support unit while patency of the airway is maintained. If the lips of an infant or child who is not breathing or who is struggling to breathe are blue, not enough oxygen is reaching the blood and rescue breathing is applied.

BREATHING

Rescue breathing refers to the ventilation of a nonbreathing infant, child or adult by rescuer. If the victim is an infant, the rescuer must cover both the mouth and the nose and make a seal. If the child is large enough so that a tight seal cannot be made over both nose and mouth together, the nose is pinched as in the adult, and only the mouth of the child is covered as in ventilation of the adult victim (Fig. 3.).



Fig. 3. Rescue Breathing

When an airtight seal has been established -- either mouth-to-nose and mouth, or mouth-to-mouth, four gentle breaths are delivered in rapid succession without allow-

ing for full lung deflation. These four quick breaths serve as a means of checking for airway obstruction as well as opening the small air sacs in the lungs. The lungs of a child and especially an infant are smaller than those of an adult and have a correspondingly smaller volume. Ventilation should be limited to the amount of air needed to cause the chest to rise. It should not, however, be forgotten that the smaller air passages provide a greater resistance to air flow, and the rescuer's blowing pressure will probably have to be greater than he imagines. As soon as the chest, which should be carefully watched, is seen to rise and fall, the right amount of force is being used.

In the past great emphasis has been placed on not blowing too hard for fear of causing rupture of the air sacs. This is indeed an ongoing concern, but emergency room personnel have been impressed with the fact that most infants and children are being underventilated rather than overventilated. The key is to watch for a rise in the chest; if it doesn't occur check for airway patency and blow harder.

If air enters freely with the four breaths and the chest rises, the airway is clear and the rescuer proceeds with checking the pulse. If air does not enter freely, patency of the airway should be checked. If, after readjustments of head extension and chin lift, air still does not enter freely, an obstruction must be suspected.

Gastric Distension. -- Artificial ventilation can cause stomach distention that, if excessive, can interfere with rescue breathing by elevating the diaphragm and thus decreasing lung volume. The incidence of gastric distension can be minimized by limiting ventilation volumes to the point at which the chest rises, thereby avoiding exceeding the esophageal opening pressure. Attempts at relieving gastric distension by pressure on the abdomen should be avoided because of the danger of aspirating stomach contents into the lungs. Gastric decompression should be attempted only if the abdomen is so tense that ventilation is ineffective. In such a situation, the infant or child's entire body is turned to the side before pressure is applied to the abdomen.

Airway Obstruction. -- It should be kept in mind that airway obstruction with secondary cardiac arrest is much more common in infants and children than cardiac arrest with secondary airway obstruction. Airway obstruction can be caused by a foreign body such as a toy, peanut, or other small objects or may be caused by an infection which causes swelling of the airway such as occurs in croup or epiglottitis. The differentiation between a foreign body and an infectious cause is important, since in the latter cause, going through the following steps for dislodging a foreign body will not be helpful, can be dangerous, and will cause delay in transporting the child to an appropriate advanced life support unit. The signs of croup or epiglottitis are those of airway obstruction, and the underlying cause can only be suspected at the time of an emergency by the circumstances under which the event occurred. A child who has been ill with fever, a barking cough, and progressive airway obstruction needs transportation to the nearest advanced life support facility, whereas a child, previously healthy, who chokes while eating peanuts or playing with small toys and has difficulty in breathing may need CPR and relief of the airway obstruction. Foreign bodies may cause partial or complete airway obstruction. With partial airway obstruction, the victim may be capable of either good air exchange or poor air exchange. With good air exchange, the victim can cough forcefully, although there may be wheezing between the coughs. As long as good air exchange continues, the victim should be allowed and encouraged to persist with spontaneous coughing and breathing efforts. At this point, the rescuer should not interfere with the victim's attempts to expel the foreign body.

Poor air exchange may be present initially, or good air exchange may progress to poor air exchange. Poor air exchange is characterized by an ineffective cough, high pitched noises while inhaling, increased respiratory difficulty, and especially blueness of the lips, nails, and skin. Partial obstruction with poor air exchange should be managed as a complete obstruction. Relief of foreign body airway obstruction is achieved through a combination of back blows and chest thrusts. Abdominal thrusts are not recommended in infants and children because of their potential danger of injury to the abdominal organs, especially the liver.

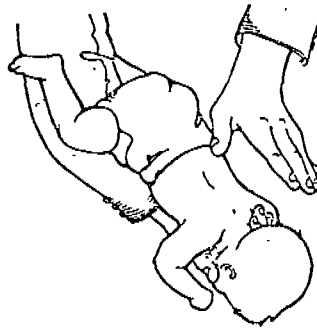


Fig. 4. Back Blows

If the victim is an infant, he is straddled over the rescuer's arm with the head lower than the trunk. The head must be supported with a hand around the jaw and chest (Fig. 4.). For additional support, it is advisable for the rescuer to rest the forearm on his thigh. Four back blows are rapidly delivered with the heel of the hand between the infant's shoulder blades. Care must be exercised, since much less force needs to be exerted than in the adult. Immediately after delivering the back blows, the rescuer places his free hand on the infant's back so that the victim is sandwiched between the two hands, one supporting the neck, jaw, and chest, while the other is in a position to support the back.

While continuing to provide support to the head and neck, the victim is turned and placed on the thigh with the head lower than the trunk, and four chest thrusts are delivered in rapid succession in the same manner as external chest compressions are performed in the infant.

If the victim is a child, too large to straddle the rescuer's forearm, the rescuer kneels on the floor and drapes the victim across the thighs, keeping the head lower than the trunk (Fig. 5.).



Fig. 5. Back Blows, Child

The four back blows can be delivered with somewhat greater force than that used for the infant. With the head and back supported, the child is rolled over onto the floor and is now in position for the four chest thrusts. These are applied in the same manner as external chest compression is applied for the child, using only the heel of one hand. Blind finger sweeps are to be avoided in infants and children since the foreign body can easily be pushed back and cause further obstruction. In the unconscious victim, immediately after the chest thrusts, the tongue and lower jaw are lifted forward and the mouth opened. This is done by placing the thumb in the victim's mouth over the tongue, the other fingers are wrapped around the lower jaw. If the foreign body is visualized, it may be removed.

If the victim has not started breathing after this maneuver, the airway should again be opened and a seal made over the mouth or the mouth-nose of the victim and an attempt made to deliver four breaths. If the chest does not rise, the obstruction persists, and its relief must again be sought via the above technique.

Recommended Sequence for Relief of Obstruction

1. For the Conscious Choking Infant or Child:
 - a) Identify complete airway obstruction (in the infant look at color of lips to see if they are blue; in the older child check ability to speak).
 - b) Apply four back blows in rapid succession.
 - c) Apply four manual chest thrusts.
 - d) Repeat b and c until they are effective or the victim becomes unconscious.
2. For the Choking Infant or Child Who Becomes Unconscious:
 - a) Call for help and if a second person is available activate the EMS System.
 - b) Open airway and ventilate - if unable to ventilate then
 - c) Apply four back blows in rapid succession.
 - d) Apply four manual chest thrusts.
 - e) Open mouth and if foreign body is visualized remove it with a finger sweep.
 - f) Reposition the head, open the airway and attempt to ventilate. If the infant or child cannot be ventilated then
 - g) Repeat above steps.

CIRCULATION

Checking the Pulse. -- Once the airway has been opened and four breaths delivered, it must be determined whether only breathing has stopped or whether a cardiac arrest has also occurred. Cardiac arrest is recognized by absence of a pulse in the large arteries in an unconscious victim who is not breathing. The pulse in a child can be felt over the carotid artery in a manner similar to that described for the adult. The feeling of a pulse in an infant is more of a problem. Unfortunately, the very short and at times fat neck of an infant makes the carotid pulse difficult to feel. Precordial activity represents an impulse rather than a pulse and has been found not to be reliable. Some infants with good cardiac activity may have a quiet precordium, leading to the erroneous impression that chest compression is indicated. Because of this difficulty, it is recommended that in infants the brachial pulse be checked. With practice, this can be as easily mastered as palpating a carotid pulse.

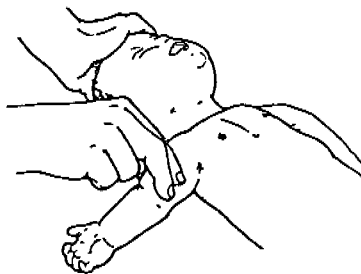


Fig. 6. Brachial Pulse

The brachial pulse is located on the inside of the upper arm, midway between the elbow and the shoulder (Fig. 6.). The rescuer's thumb is placed on the outside of the arm, between the shoulder and the elbow. The tips of the index and middle fingers are placed on the opposite side of the arm. The index and middle fingers are pressed lightly toward the bone until the pulse is felt.

When there is a pulse but no breathing, then only breathing has arrested. Rescue breathing must continue as long as the infant or child cannot breathe for himself. Ventilation should be gentle, just enough to make the chest rise, and if the infant or child is struggling for breath, ventilation should be coordinated with the victim's respiratory effort. As the victim attempts to breath in, the rescuer should breathe out into the victim's lungs.

Anyone observing an infant or child breathing will note that the smaller the child, the more rapid is the natural breathing rate. Breathing rates for infants and children under conditions of resuscitation should be more rapid than for adults: (a) Infant -- breathe once every 3 seconds or 20 times per minute; (b) Child -- breathe once every 4 seconds or 15 times per minute.

External Chest Compression. -- If the victim's pulse is not palpable, then a combination of rescue breathing and chest compression is indicated to circulate blood around the body. Rescue breathing alone is indicated when breathing has stopped, but a pulse is still palpable. Chest compression is never performed without rescue breathing. It is in the technique of external chest compression that differences between infants, children, and adults become most apparent. The differences are related to the position of the heart within the chest, the small size of the chest, and the faster heart rate of the infant and child as compared with that of the adult.

Position of the Heart. -- As the chest grows, the proportion occupied by the heart diminishes. The heart in the infant and child is situated higher in the chest than it is in the adult. The proper area of compression in the infant is the mid sternum (Fig. 7.).

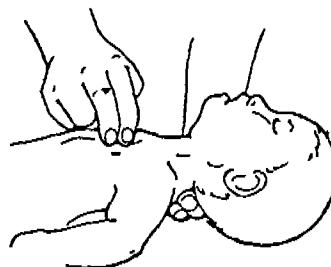


Fig. 7. Compression

If an imaginary line is drawn between the nipples, the proper area of compression is the mid portion of this line. A child's heart is lower than an infant's but not as low as an adult's. Using the technique as described for the adult, the notch where the ribs join in the center of the chest is located with the middle finger. The area just above the index finger is the appropriate area of compression in the child.

The chest of an infant or child is smaller and more pliable than that of an adult. Two hands are not necessary for proper compression. In an infant, two or three fingers are adequate (Fig. 7.). With the fingers on the mid-sternum (between the nipples), the breast bone is compressed $\frac{1}{2}$ "-1" (1.3-2.5 cm). The victim should lie on a hard surface to achieve best results. In the child, more force will have to be exerted. If the infant or child is large enough so that the sternum will not easily compress with three fingers, the heel of one hand will be needed. Only the heel of the hand should be used; the fingers must be kept off the chest. If the victim is large enough to require the heel of the hand for compression, the depth should be increased to 1"-1½" (2.5-3.8 cm).

Because of the inherently faster heart rate in infants and children, the compression rate must also be faster as follows (1) Infants - 100 compressions per minute; (2) Children - 80 compressions per minute.

External chest compression must always be accompanied by rescue breathing, and the two must be coordinated. The ratio of compressions to respirations is 5:1, both for single and for two rescuers. In infants and small children, backward tilt of the head lifts the back. A firm support beneath the back is therefore required for external chest compression and can be provided by the rescuer slipping one hand beneath the child's back while using the other hand to compress the chest. A folded blanket or other adjunct can also be used beneath the back to provide support. This helps to maintain head tilt and an open airway. Head tilt can also be maintained by utilizing the hand not performing compressions. When only a single rescuer is present, after each fifth compression a breath is interposed without stopping compressions.

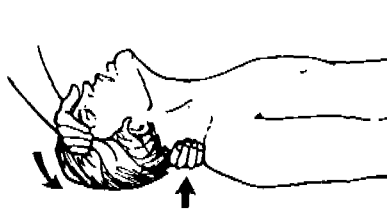
Compressions should be counted by the rescuer performing the compression as follows: (1) Infant -- One, two, three, four, five, (breathe); (2) Child -- One and two and three and four and five (and breathe).

"Training in Cardiopulmonary Resuscitation and Emergency Cardiac Care must be according to the standards of the American Heart Association."

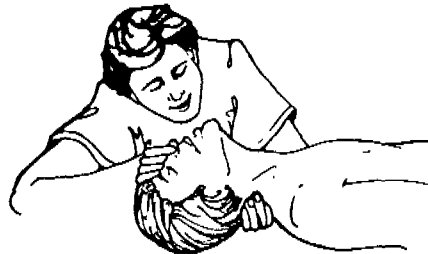
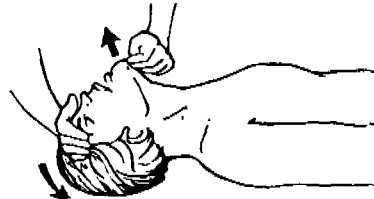


Recommendations of National Conference on CPR and ECC, National Academy of Sciences, National Research Council, American Medical Association, Commission on Emergency Medical Services, JAMA, August 1, 1980 Vol. 244 No. 5.

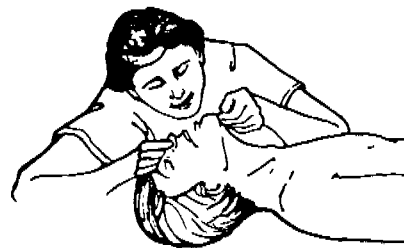
CARDIOPULMONARY RESUSCITATION (CPR) (Basic Life Support — Adult)



Airway



Breathing



Circulation



This material has been reprinted from Chapters V and XI of "A Manual for Instructors of Basic Cardiac Life Support" by the American Heart Association.

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