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current Emergency Diagnosis & Treatment

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Handbook of Pediatrics, 14th ed. H.K. Silver, C.H. Kempe, and H.B. Bruyn. 883 pp, *illus.*	1983
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This book is dedicated to J. Englebert Dunphy, MD, who was an inspiration to all of us as a physician, surgeon, and teacher and who was an important motivating force in the conception and preparation of this book.

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Preface

It is now commonplace for hospital emergency care to be provided by specialists in this division of medicine. Improvements in emergency transportation systems and in the quality of care provided before the patient reaches the hospital—combined with sophisticated equipment and specially trained personnel able to provide optimal care—have led to an increase in the number of patients visiting the emergency department, the number of hospitals with emergency departments, and the number of physicians practicing emergency medicine.

The increase in the number of textbooks on emergency care has paralleled the growth of emergency medicine. We believe that many of these books do not address 2 unique points of emergency care: (1) the diagnosis is often unknown when the patient is first evaluated in the emergency department, and (2) evaluation and treatment must proceed rapidly and simultaneously in the critically ill patient. *Current Emergency Diagnosis & Treatment* offers an approach to the management of seriously ill patients who have signs or symptoms of disease but in whom the diagnosis is unknown. It also offers specific guidelines for diagnosis, consultation, treatment, disposition, and referral for the conditions most commonly encountered in the emergency department. Because of the book's practical orientation, basic science and pathophysiologic principles are not stressed except when they are germane to management. Likewise, there is only occasional brief mention of continuing hospital care; the reader is referred to specialized texts for additional information on hospital-based or long-term ambulatory care.

We would like to thank Patricia Salber, MD, and Carol A. Raviola, MD, for their helpful comments and criticisms.

The editors welcome comments and criticisms regarding this text and ask that they be sent to Lange Medical Publications.

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Mary T. Ho, MD
Donald D. Trunkey, MD

San Francisco
September, 1983

NOTICE

The authors and editors have made every responsible effort to offer recommendations for diagnosis and emergency treatment based on current concepts of care. The reader should note, however, that the ultimate responsibility for patient care rests with the physician or other health professional who performs or gives the order to perform the procedures described in these pages.

Drug indications and drug dosages in this book are not in all cases in agreement with recommendations of the Food and Drug Administration. The manufacturer's package insert is the best source of information on FDA opinion regarding drug dosages and indications. The reader should note that standards for usage and dosage may change, particularly as regards relatively new drugs.

–THE PUBLISHERS

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Cardiopulmonary Resuscitation (CPR) | 1

Mary T. Ho, MD, & John Mills, MD

BASIC CARDIOPULMONARY RESUSCITATION (CPR)

TECHNIQUE OF CPR

Step 1: Verify Unconsciousness.

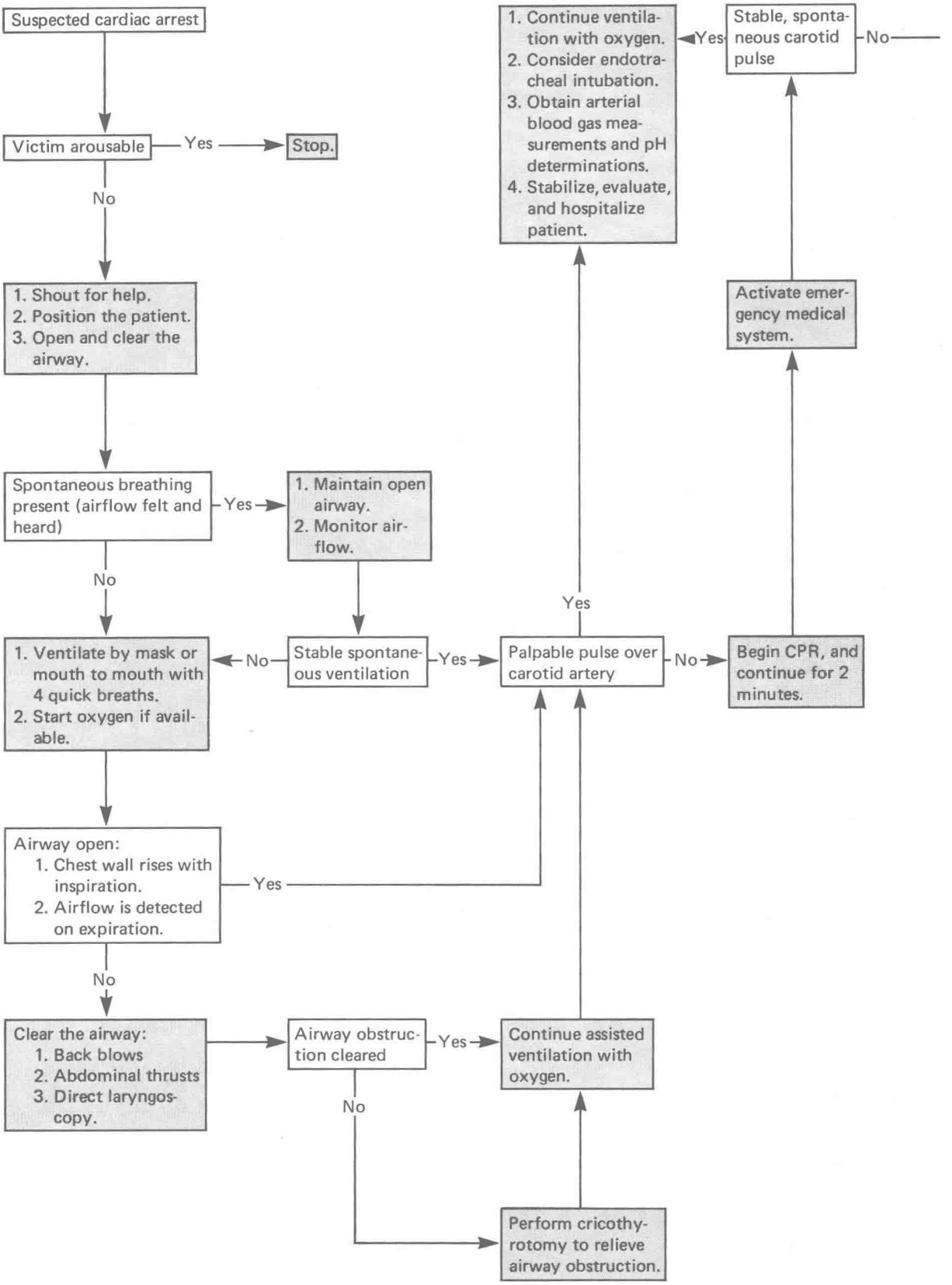
The physician confronted with a person in an apparently collapsed state who may require lifesaving resuscitation measures must first determine whether or not unconsciousness has occurred. Shake the victim gently and shout, "Are you all right? Are you okay?" The victim may have fainted or may be just sleeping. Shouting and gentle shaking are usually enough to revive or awaken the victim in such cases. If there is no response, cardiac or respiratory arrest may be present, and the procedures listed below must be followed.

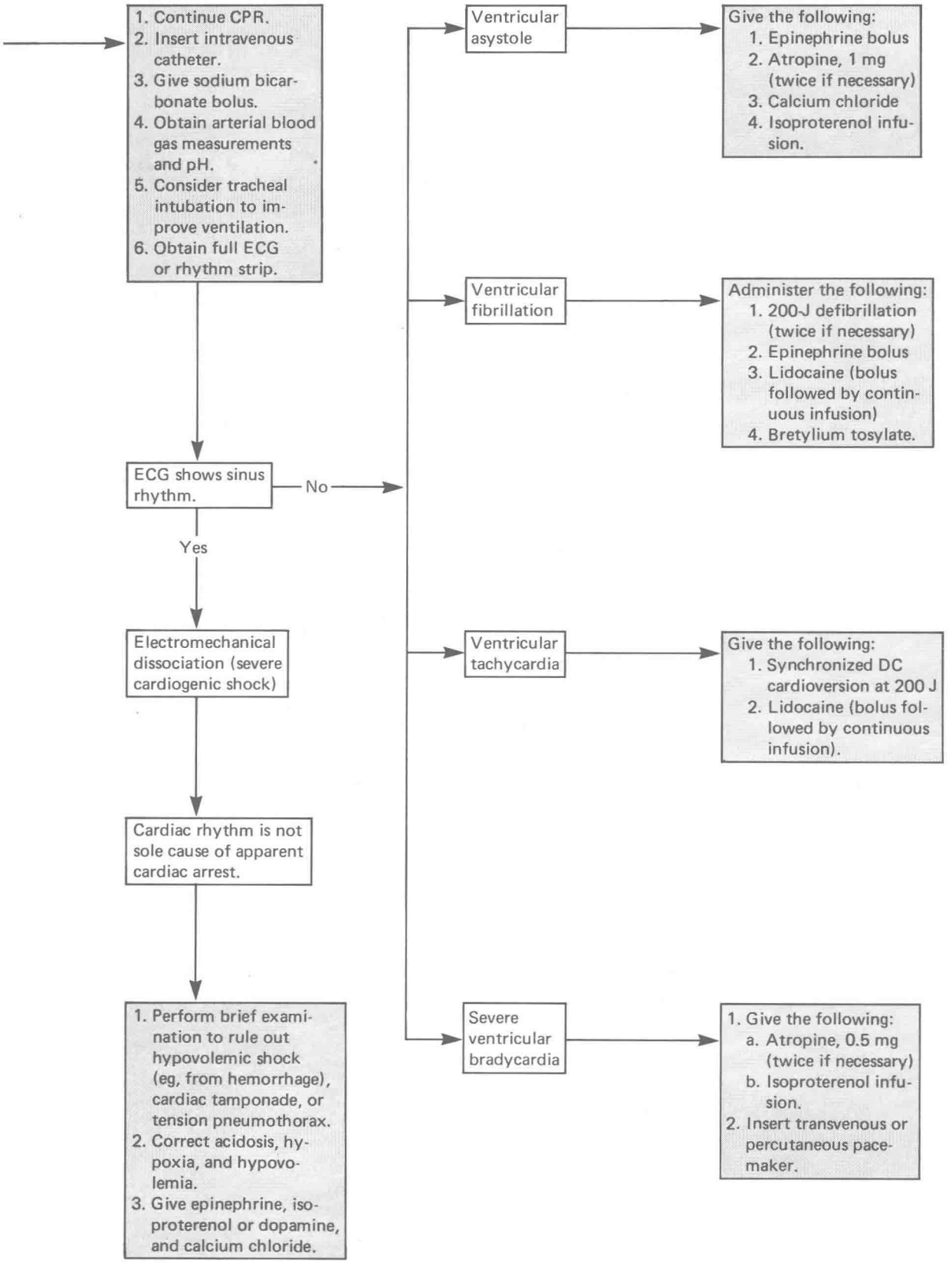
Step 2: Shout for Help.

Assistance is essential, since a single rescuer cannot perform CPR and call for an ambulance simultaneously. Even if no one is in sight, attempt to summon help by shouting.

Step 3: Position the Patient.

The unconscious victim must be positioned to allow further assessment and management. Place the patient face up (extended supine position) on a firm, level surface. Control the head and neck while turning the patient, especially if signs of trauma are present, since fractures or internal injuries may be made worse by rough handling.


Suspected cardiac arrest
Victim arousable
Yes
Stop.
No
1. Shout for help.
2. Position the patient.
3. Open and clear the airway.
Spontaneous breathing present (airflow felt and heard)
Yes
1. Maintain open airway.
2. Monitor airflow.
No
1. Ventilate by mask or mouth to mouth with 4 quick breaths.
2. Start oxygen if available.
No
Stable spontaneous ventilation
Yes
Palpable pulse over carotid artery
No
Begin CPR, and continue for 2 minutes.
Activate emergency medical system.
Yes
1. Continue ventilation with oxygen.
2. Consider endotracheal intubation.
3. Obtain arterial blood gas measurements and pH determinations.
4. Stabilize, evaluate, and hospitalize patient.
Yes
Stable, spontaneous carotid pulse
No
Airway open:
1. Chest wall rises with inspiration.
2. Airflow is detected on expiration.
Yes
No
Clear the airway:
1. Back blows
2. Abdominal thrusts
3. Direct laryngoscopy.
Airway obstruction cleared
Yes
Continue assisted ventilation with oxygen.
No
Perform cricothyrotomy to relieve airway obstruction.


1. Continue CPR.
2. Insert intravenous catheter.
3. Give sodium bicarbonate bolus.
4. Obtain arterial blood gas measurements and pH.
5. Consider tracheal intubation to improve ventilation.
6. Obtain full ECG or rhythm strip.
ECG shows sinus rhythm.
No
Yes
Electromechanical dissociation (severe cardiogenic shock)
Cardiac rhythm is not sole cause of apparent cardiac arrest.
1. Perform brief examination to rule out hypovolemic shock (eg, from hemorrhage), cardiac tamponade, or tension pneumothorax.
2. Correct acidosis, hypoxia, and hypovolemia.
3. Give epinephrine, isoproterenol or dopamine, and calcium chloride.
Ventricular asystole
Give the following:
1. Epinephrine bolus
2. Atropine, 1 mg (twice if necessary)
3. Calcium chloride
4. Isoproterenol infusion.
Ventricular fibrillation
Administer the following:
1. 200-J defibrillation (twice if necessary)
2. Epinephrine bolus
3. Lidocaine (bolus followed by continuous infusion)
4. Bretylium tosylate.
Ventricular tachycardia
Give the following:
1. Synchronized DC cardioversion at 200 J
2. Lidocaine (bolus followed by continuous infusion).
Severe ventricular bradycardia
1. Give the following:
a. Atropine, 0.5 mg (twice if necessary)
b. Isoproterenol infusion.
2. Insert transvenous or percutaneous pacemaker.

The ABCs of CPR

The initial steps of CPR may be remembered by using the mnemonic *A–B–C*:

A = *A*irway
B = *B*reathing
C = *C*irculation

Step 4: Establish Airway.

Establish and maintain an open airway *immediately*. With unconsciousness, the tongue falls posteriorly and may obstruct the airway (Fig 1–1).

A. No Cervical Spine Injury: Opening and maintaining an airway is best achieved by backward extension of the neck and forward displacement of the mandible (Fig 1–1). The **head tilt and neck lift method** consists of extending the neck with one hand while pressing down on the forehead with the other hand (Fig 1–1).

The airway can also be maintained through use of the **head tilt and chin lift method:** Place one hand on the forehead and the other on the bony portion of the mandible (chin). Use the hand on the mandible to tilt the head backward (Fig 1–2B). If necessary, use one thumb to spread the jaws and keep the mouth open.

B. Suspected Cervical Spine Injury: If a victim of respiratory arrest has a suspected or documented cervical spine injury—a rare combination—the ventilation technique must be modified to avoid cervical spinal cord injury. The patient should be on a hard surface for CPR, as this factor alone provides some protection for the neck. Place sandbags on both sides of the neck and head to prevent lateral movement.

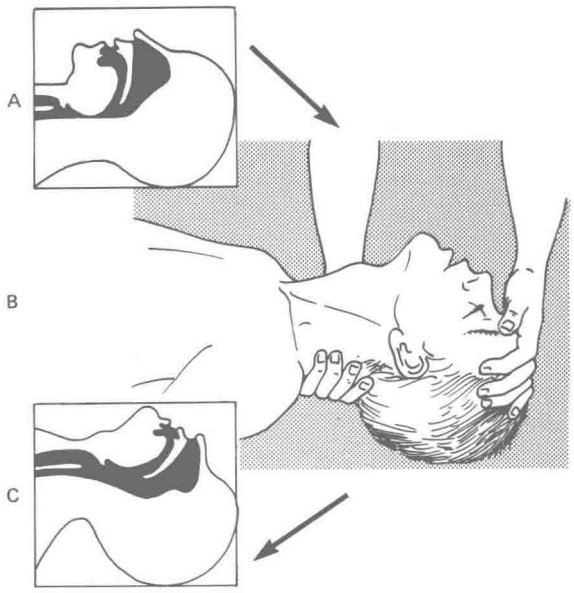


Figure 1–1. Opening the airway. *A:* Obstruction of airway by posterior displacement of tongue in resting, supine position. *B* and *C:* Relief of lingual airway obstruction in supine position by neck extension and forward displacement of mandible (head tilt and neck lift method).

Avoid extension and flexion of the neck. Open the airway by forcefully lifting the mandible with thumb or fingers behind the angle of the jaw. A rubber nasal airway or plastic oropharyngeal airway may be helpful in keeping the tongue from occluding the upper airway.

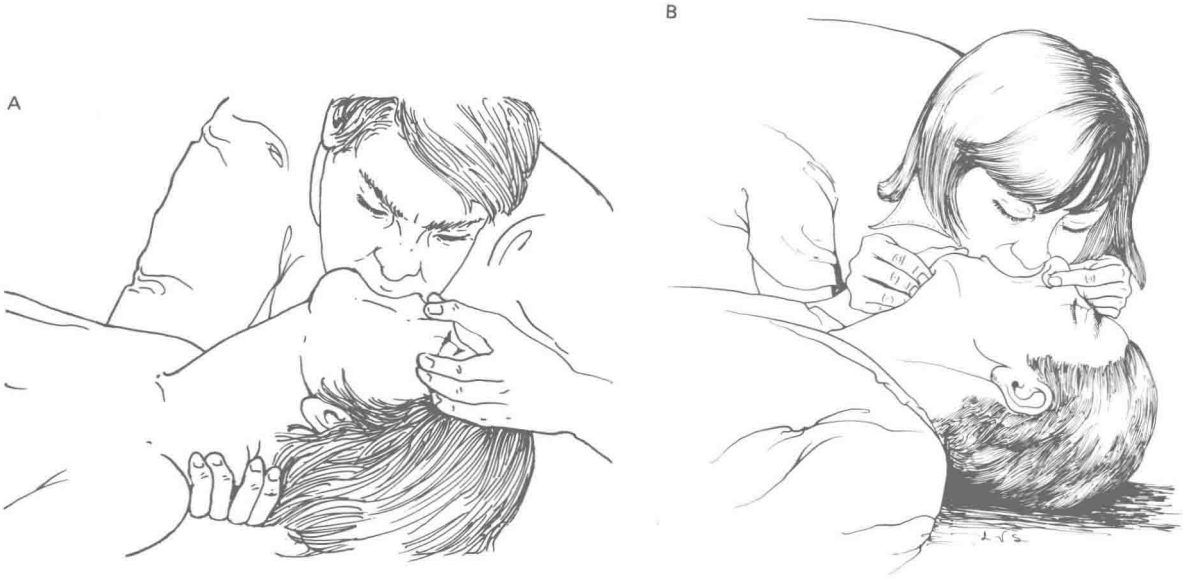


Figure 1–2. Mouth-to-mouth ventilation, inspiratory phase. *A:* Victim's neck is extended, with nose sealed by rescuer's fingers; rescuer takes deep breath, seals mouth over victim's mouth, and exhales, watching for chest movement. *B:* Alternative method, using hand under jaw to extend neck and stabilize mandible (head tilt and chin lift method).

Step 5: Check for Spontaneous Ventilation.

Once the airway is open, check for signs of adequate respiratory exchange. Spontaneous ventilation is accompanied by chest movement associated with audible or palpable airflow at the mouth. Put one ear close to the victim's mouth, and listen for breath sounds. Feel for exhaled air on your cheek, and look to see if the chest rises and falls. Spend at least 5 seconds checking for breathing before concluding that it is absent. If spontaneous ventilation is occurring, go to step 7, Check Circulation.

Step 6: Begin Ventilation.

(Figs 1–2 to 1–4)

A. Technique: If there are no signs of breathing, begin ventilation immediately. To provide positive pressure ventilation through the mouth, the nasal air passage must be closed. Tilt the head backward, and with the thumb and index finger of the hand on the victim's forehead, pinch the victim's nostrils closed. Seal your mouth over the victim's mouth as shown in Fig 1–2A, and give 4 quick full breaths in rapid succession so that the lungs do not completely deflate (ie, return to functional residual capacity) between inflations. The cumulative effect of breaths given in this way ensures full reinflation of the lungs. Watch the chest for movement, and listen and feel for exhalation (Fig 1–3).

If the victim's mouth is damaged or is too large to be covered by the rescuer's mouth, mouth-to-nose ventilation should be performed by blowing directly into the victim's nose with the victim's mouth closed. Open the victim's mouth to allow for passive exhalation. Mouth-to-nose ventilation may be an effective way to ventilate a victim with facial burns or one who has swallowed a caustic substance.

Figure 1–3. Mouth-to-mouth ventilation, expiratory phase. After inflating victim's lungs, rescuer listens and feels for passive exhalation while looking to see if chest wall falls.

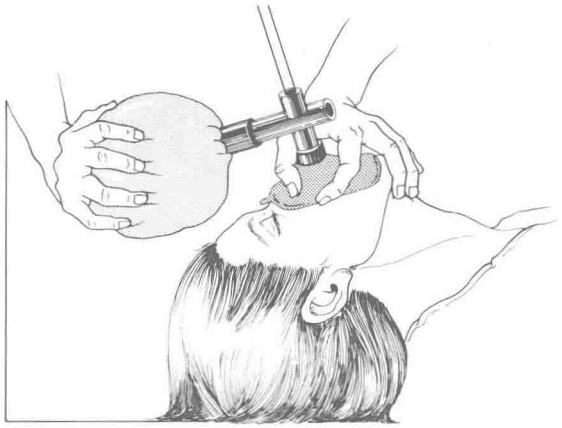


Figure 1–4. Ventilation technique using face mask and positive pressure ventilation (bag or valve). As in mouth-to-mouth ventilation, neck must be extended to keep airway open. Seal mask to face with one hand, with fingers under mandible to maintain neck extension and an open airway. Use other hand to operate bag or valve.

Mouth-to-mouth resuscitation must often be the initial step in active ventilatory support. Subsequently—or initially if equipment is available—use of a bag, valve, and mask system (eg, Ambu bag) may provide larger tidal volumes and higher inspired oxygen concentration (Fig 1–4).

B. Detection of Airway Obstruction: If the airway is obstructed, the rescuer will feel an impediment to ventilation that is detected in any of 4 ways: **(1)** The rescuer is unable to blow air into the victim's lungs, or doing so requires excessive expiratory effort; **(2)** the victim's chest does not rise with the ventilation as it should if the lungs are being inflated; **(3)** no airflow can be perceived on passive exhalation (Fig 1–3); or **(4)** auscultation of the chest by an assistant fails to disclose sounds of air exchange.

C. Relief of Airway Obstruction:

1. Reposition head–If attempts at ventilation are unsuccessful, reposition the head once again (Fig 1–1). ***Note:*** *Insufficient hyperextension of the neck, causing obstruction of the airway by the tongue, is the commonest cause of airway obstruction during CPR.*

After the head is repositioned, attempt ventilation again.

2. Give back blows–If the airway remains occluded, turn the victim onto one side. Control the head and neck, and deliver 4 forceful blows to the back in rapid succession to the interscapular area with the heel of one hand (Fig 1–5A). Proceed immediately to abdominal thrusts.

3. Deliver abdominal thrusts–Return the victim to the extended supine position, and deliver abdominal thrusts midway between the navel and the xiphisternal notch (Fig 1–5B). Deliver 4 upward