

Effective bag-valve-mask ventilation saves lives

Simple techniques help you ensure proper ventilation of patients in respiratory distress or respiratory arrest.

By Huy Vo, MSN, CRNA; Matthew Park, MSN, CRNA; and Simson Wang, MSN, CRNA



ROBERT WALKER*, your patient in the postanesthesia care unit, is recovering from laparoscopic cholecystectomy. The anesthesia provider tells you that the patient's history is unremarkable and surgery went well. When you speak to Mr. Walker, he's lethargic but awake and following commands. His vital signs are normal, and he's receiving oxygen by face mask. He complains of moderate abdominal pain, and the anesthesiologist prescribes I.V. hydromorphone. Fifteen minutes later, you notice that Mr. Walker's breathing is slow and shallow. He doesn't respond to verbal commands but awakens with vigorous tactile stimulation. His pulse oximetry reading drops from 99% to 90%. What should you do?

Your knowledge and skill in basic airway management can mean the difference between life and death for your patient. This article offers simple, helpful tips for managing patients in respiratory distress

or respiratory arrest using bag-valve-mask (BVM) ventilation. Applying these tips can help you save precious time.

What can go wrong

The respiratory system acts as a conduit for exchanging oxygen and carbon dioxide and fueling cells. (See *Airway A & P primer*.) When gas exchange is interrupted, respiratory distress may occur. This distress may be associated with an upper-airway obstruction, such as pharyngeal edema, laryngeal edema, trauma, or a foreign body lodged in the airway. But the most common cause of an upper-airway obstruction is the tongue. (See *Tongue trouble*.) Left untreated, res-

piratory distress can progress to respiratory arrest.

When you need BVM

You should use BVM ventilation in the following situations:

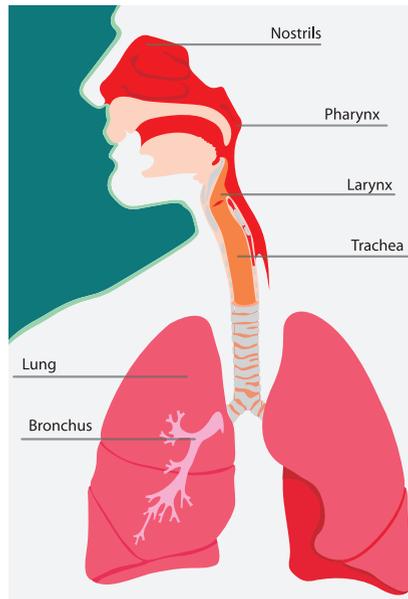
- a patient whose breathing is bradypneic, tachypneic, shallow, or weak
 - a patient who has a decreased level of consciousness with or without decreased oxygen saturation
 - a patient who is not breathing.
- These indications are part of the ABCs of resuscitation, which start after you call for help when you find a patient in respiratory distress.
- **Airway.** Is the airway open? If the patient is unconscious, open the airway using the head tilt/chin lift (or jaw thrust if you suspect a cervical spine injury).
 - **Breathing.** Is the patient breathing? If so, how effective are the breaths? In Mr. Walker's case, his respiratory distress presents as

Airway A & P primer

The anatomy of the respiratory system can be divided into two parts: the upper and lower airway. The upper airway, which is involved with *ventilation*, includes the nose, pharynx, and larynx. Patients undergoing general anesthesia are intubated with an endotracheal tube, which is inserted past the larynx and into the trachea, for the duration of surgery.

The lower airway, which includes the trachea, bronchi, and lungs, plays a part in *oxygenation*.

Ventilation and oxygenation are often used interchangeably, but they have two distinct definitions. Ventilation moves air in and out of the lungs, while oxygenation is the process by which gas exchange of oxygen occurs. Think of ventilation as the physical act of breathing involving the upper-airway structures (nose, pharynx, and larynx) and oxygenation as the physiological act of breathing involving the lower-airway structures (trachea, bronchi, and lungs).



you're providing ventilation, watch for the rise and fall of your patient's chest, listen for clear breath sounds on auscultation, and check for improved oxygen saturation and skin color.

Applying techniques you learned in basic life support help you manage the patient's airway and ensure effective BVM ventilation.

Using the head-tilt/chin-lift maneuver

Use the head-tilt/chin-lift maneuver to open a patient's airway, unless you suspect cervical spine injury, in which case, you should use a modified jaw thrust. Position the mask so it covers the patient's nose and mouth. If the mask sits over the patient's chin, you may have to readjust it so it sits near the edge of the chin, or get a smaller mask.

Inserting an oral or nasal airway

If you can't provide adequate ventilation, the patient's tongue may be obstructing the upper airway. Use an oral or nasal airway to displace the tongue forward. You can learn more about selecting and correctly placing oral and nasal airways at

slow, shallow breaths and a falling pulse oximetry reading. He needs your help with BVM.

- **Circulation.** Does the patient have a pulse? If not, start chest compressions. Fortunately, Mr. Walker has a pulse.

Be sure a colleague gathers essential airway management equipment, using the S.O.A.P. mnemonic to ensure everything necessary is brought to the bedside:

S—Suction

O—Oxygen

A—Airway (BVM, oral and nasal airways, endotracheal tube, laryngoscope blade, and airway crash cart)

P—Pharmacy (advanced cardiac life support drugs that are found on many crash carts).

Performing BVM ventilation

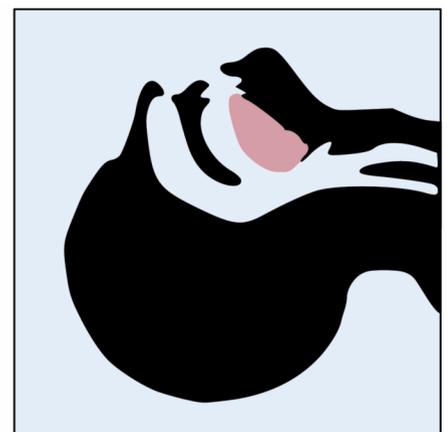
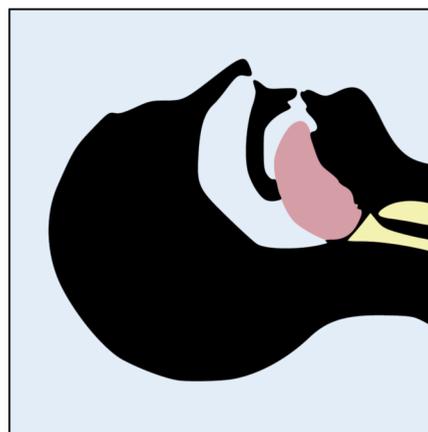
In patients like Mr. Walker who are experiencing respiratory distress but still breathing, use BVM ventilation to provide assistive breaths. Attach the BVM to an oxygen flow meter at greater than 10 L/min. Place the mask over the patient's mouth and nose with one hand and, using your other hand, follow the pa-

tient's breathing by gently and slowly squeezing the BVM to provide assistive ventilation.

Be aware that hyperventilation and overinflation forces air into the stomach, which can lead to gastric distention and place the patient at risk for aspiration. Also, the patient won't be adequately ventilated. As

Tongue trouble

The illustration on the left shows the patient's tongue obstructing the upper airway. In the illustration on the right, the patient's head has been properly positioned to move the tongue forward, so air can flow into the lungs.



Wikimedia commons, Vassia Atanassova (Spiritia)

Proper finger placement during BVM ventilation

Getting and maintaining a tight seal on the bag-valve-mask (BVM) requires proper technique. These photos illustrate what to do and what not to do.



Correct: With the middle, ring, and pinkie fingers placed along the mandibular bone, the mandible is pulled up into the mask. The index and thumb are used to create a tight seal around the mouth and nose.



Incorrect: In this photo, the middle, ring, and pinkie fingers are on the soft tissue under the chin, which will worsen airway obstruction by pulling the tongue farther into the posterior pharynx. Also, the mask is pushed into the patient's face.

Troubleshooting BVM problems

The following table, organized using the MOANS acronym, lists difficulties you might encounter when using a bag-valve-mask (BVM), along with potential solutions.

Difficulty	Solutions	
Mask seal	Difficulty maintaining mask seal on patients with facial hair, large facial structures, or no teeth	Use water-soluble lubricant over facial hair to seal contact between mask and face. Use oral airway if having difficulty obtaining adequate seal with facial hair or no teeth. Consider two-hand, two-person ventilation.
Obese	Difficulty maintaining mask seal and providing adequate breaths due to increased redundant tissue (such as a large tongue, thick neck, or excess adipose tissue around face or neck) around upper airway, which can lead to obstruction	Use oral or nasal airway to displace redundant tissue and open airway. Place patient in reverse Trendelenburg position with a roll under patient's head when attempting to use BVM. This displaces excess abdominal and chest tissue weight, allowing improved chest expansion with ventilation. Goal is to achieve horizontal line from external auditory meatus to sternal notch. In morbidly obese patients, two-person technique works best.
Age > 55	Difficulty maintaining mask seal with older patients	Use oral airway to open patient's airway. Leave dentures in place to improve mask seal.
No teeth	Difficulty maintaining mask seal on patients with poor dentition or no teeth	Use oral airway to improve mask seal. Leave dentures in place to improve mask seal.
Stiff	Difficulty providing adequate breaths to patients with asthma, COPD, ARDS, or pregnancy	Use albuterol or ipratropium to bronchodilate lungs; use PEEP valve, if available.

BVM: bag valve mask; COPD: chronic obstructive pulmonary disease; ARDS: acute respiratory distress syndrome; PEEP: positive end-expiratory pressure

the American Red Cross website: <https://goo.gl/ONBzDT>.

Maintaining a tight seal

To ensure oxygen is delivered to the lungs, you need an airtight seal over the patient's mouth. To maintain that seal, use the E-C technique to hold the BVM: First, create a C-shape with your thumb and index finger over the top of the mask and apply gentle downward pressure. Then hook your pinkie, ring, and middle fingers around the patient's mandible and lift it up toward the mask, creating an E.

Another option is the E-O technique. In this method, you use the web between your thumb and index finger to encircle the neck of the mask, while you lift the chin with your other fingers to provide chin lift.

If you have difficulty with the one-handed E-C or E-O techniques and another provider is with you, switch to the two-handed, two-person technique. Using both hands, grasp each side of the patient's face using the E-C technique. Then pull the mandible up into the mask to provide an airtight seal. While you maintain the seal, the other provider ventilates the patient.

Clinical pearls

Using correct BVM technique, you can ensure proper ventilation of a patient in respiratory distress or respiratory arrest. Positioning your hands correctly on the mask and assessing for potential challenges increase your chance of success.

Pull, don't push

A common mistake when performing BVM ventilation is to push the mask onto the patient's face while delivering breaths. This pushes the tongue farther into the posterior pharynx, exacerbating the upper-airway obstruction. To provide adequate ventilation, use the "E" fingers (pinkie, ring, and middle)

from the E-C technique to pull the patient's mandible into the mask, while at the same time using your thumb and index fingers to hold the mask in place.

Grasp bone, not soft tissue

Another common mistake is using the fingers to grasp the soft tissue beneath the mandible. Like pushing on the mask, grasping the soft tissue can push the tongue into the posterior pharynx, worsening the obstruction. Use the E-C or E-O techniques to avoid this error. (See *Proper finger placement during BVM ventilation.*)

MOANS

The MOANS mnemonic—mask seal, obese, age over 55, no teeth, and stiff—helps for problems you may encounter with the mask. These challenges can be overcome when you have the necessary materials and equipment nearby. (See *Troubleshooting BVM problems.*)

Airway management is the single most important skill needed to save a life.

Airway management saves lives

Regardless of your patient's comorbidities, using the simple techniques described in this article provides you with the tools you need to react quickly and appropriately when your patient suffers respiratory distress or respiratory arrest. Remember, airway management is the single most important skill needed to save a life.

Fortunately, your prompt intervention with a BVM to assist Mr. Walker's breathing sustains him until he receives naloxone to reduce the sedative effect of hydro-morphone. He does well and is

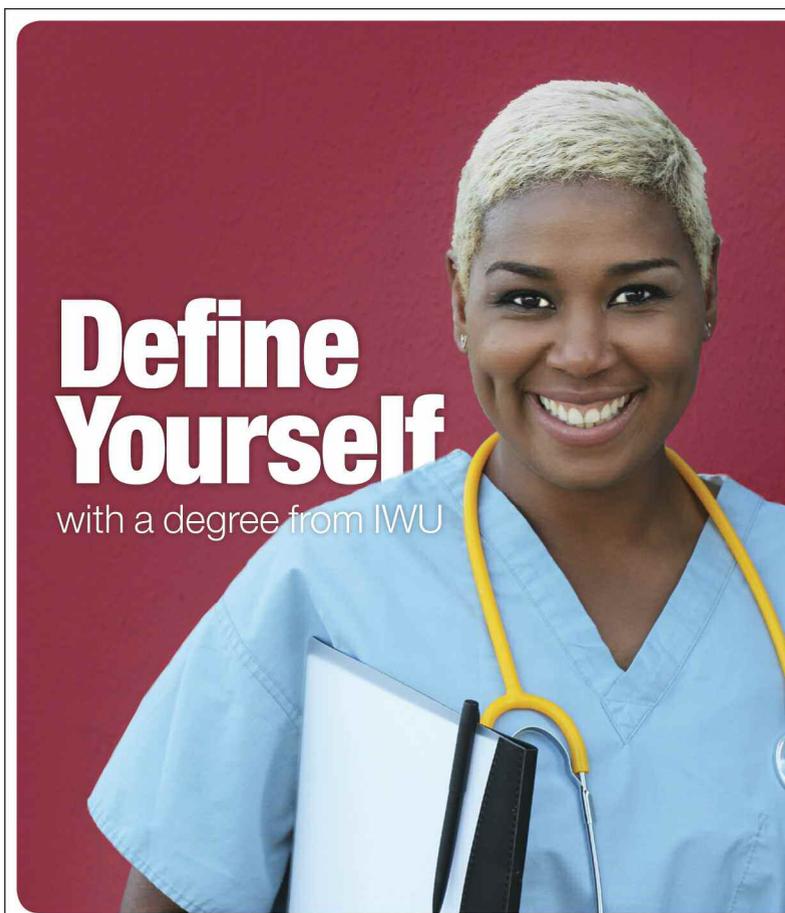
discharged home without further problems. ★

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*Names in clinical scenarios are fictitious.

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