Objectives

- Recognize signs of a threatened airway.
- Describe manual techniques for establishing an airway and for mask ventilation.
- Explain proper application of airway adjuncts.
- Describe preparation for endotracheal intubation, including the recognition of a potentially difficult intubation.
- Describe alternative methods for establishing an airway when endotracheal intubation cannot be accomplished.

Case Study

A 65-year-old man was admitted from the emergency department for worsening shortness of breath. He has a history of diabetes, hypertension, and chronic kidney disease for which he receives hemodialysis three times each week. He has missed his last two sessions of dialysis due to a gastrointestinal illness. You are called because the patient’s oxygen saturation is 86% on 100% non-rebreather mask. He is using his accessory muscles to breathe and has visible nasal flaring. A portable chest radiograph shows pulmonary edema with small bilateral pleural effusions. An initial point-of-care arterial blood gas results yield a pH of 7.18, $\text{Paco}_2$ 21 mm Hg, and $\text{Pao}_2$ 54 mm Hg. Lactic acid measured 5.2 mmol/L and potassium 6.9 mmol/L.

- Should this patient be intubated?
- If so, what drugs would be appropriate to use?
I. INTRODUCTION

This chapter focuses on the effective assessment and management of the airway. The primary goal is to maintain an open airway in order to facilitate adequate gas exchange, the A in the ABCs of resuscitation. Secondary goals include the preservation of cardiovascular stability and the prevention of aspiration of gastric contents during airway management. Endotracheal intubation will often be required, but establishing and maintaining a patent airway instead of, or prior to, intubation are equally important and often more difficult. Healthcare providers must be skilled in the manual support of an open airway and in providing the essential processes of oxygenation and ventilation. Securing an artificial airway via orotracheal or nasotracheal intubation, cricothyrotomy, or tracheostomy is an extension of, not a substitute for, the ability to maintain an open airway.

II. ASSESSMENT

Assessment of airway patency and spontaneous breathing effort is the crucial first step. The clinician must look, listen, and feel for diminished or absent air movement.

- Observe the patient’s level of consciousness and determine if apnea is present. If respiratory efforts are absent and an immediate remedy is not available, proceed to manual support and assisted ventilation while preparing to establish an artificial airway.

- Identify injury to the airway or other conditions (eg, cervical spine injury) that will affect assessment and manipulation of the airway.

- Observe chest expansion. Ventilation may be adequate with minimal thoracic excursion, but respiratory muscle activity and even vigorous chest movement do not ensure that tidal volume is adequate.

- Observe for suprasternal, supraclavicular, or intercostal retractions; laryngeal displacement toward the chest during inspiration (a tracheal tug); or nasal flaring. These often represent respiratory distress with or without airway obstruction.

- Auscultate over the neck and chest for breath sounds. Complete airway obstruction is likely when chest movement is visible but breath sounds are absent. Airway narrowing due to soft tissue, liquid, or a foreign body in the airway may be associated with snoring, stridor, gurgling, or noisy breathing.
III. MANUAL METHODS TO ESTABLISH AN AIRWAY

Initial interventions to ensure a patent airway in a spontaneously breathing patient with no possible injury to the cervical spine include the following maneuvers (Figure 2-1):

1. Slight neck extension
2. Elevation of the mandible (jaw thrust maneuver)
3. Opening of the mouth

If a cervical spine injury is suspected, neck extension should not be done. After the cervical spine is immobilized, manual elevation of the mandible and opening of the mouth are performed.

Figure 2-1. Establishing an Open Airway

The operator extends the neck and maintains extension with his/her hands on both sides of the mandible. The mandible is elevated with the fingers of both hands to lift the base of the tongue, and the thumbs or forefingers are used to open the mouth.

Airway adjuncts such as properly sized oropharyngeal or nasopharyngeal airways may be useful. The oropharyngeal airway is not used if airway reflexes are intact, as gagging, laryngospasm, and emesis may be provoked. The diameter of a nasopharyngeal airway should be the largest that will easily pass through the nostril into the nasopharynx. Its length should extend to the nasopharynx, but it should not be so long as to obstruct gas flow through the mouth or touch the epiglottis. A nasopharyngeal airway is contraindicated in patients with suspected basilar skull fracture or coagulopathy. The correct length for each airway may be estimated by placing the device against the face in the correct anatomic position (Figure 2-2).
Manual assisted ventilation by means of a bag-mask resuscitation unit is indicated:

- if the patient is apneic.
- if spontaneous tidal volumes are determined to be inadequate based on physical examination or arterial blood gas analysis.
- to reduce the work of breathing by assisting spontaneous inspiration.
- if hypoxemia is associated with poor spontaneous ventilation.

Successful manual mask ventilation depends upon: (1) maintaining an open airway, (2) establishing a seal between the patient’s face and the mask, and (3) delivering an adequate minute ventilation from the resuscitation bag to distal lung units. The first two elements are achieved through the correct placement of the mask over the patient’s nose and mouth (Figure 2-3) and establishment of an open airway, as previously described. It is useful to have masks of different sizes available in the event that the initial selection does not achieve a good seal with the face.
**A. When No Cervical Spine Injury Is Suspected**

1. If needed and tolerated by the patient, an oropharyngeal or nasopharyngeal airway may be placed to maintain a patent airway. A small pad or folded towel may be positioned under the occiput.

2. The operator stands above and behind the head of the supine patient. The height of the bed should be quickly adjusted for the comfort of the operator.

3. The base of the mask is first placed into the skin crease between the lower lip and the chin, and the mouth is gently opened.

4. The apex of the mask is placed over the nose, using care to avoid pressure on the eyes.

5. As most operators are right-handed, the mask is stabilized on the face with the left hand by holding the superior aspect of the mask apex between the thumb and first finger, adjacent to its connection to the bag. This allows gentle downward pressure on the mask over the face.

6. The fifth, fourth, and perhaps third fingers of the left hand are then placed along the left side of the mandible. It is helpful to gently encircle the left side of the mask with the soft tissues of that cheek to reinforce the seal along that edge. This further secures the mask to the patient’s face while allowing the mandible to be partially elevated.

7. The operator gently rotates the left wrist to cause slight neck extension and contracts the fingers around the mandible to raise it slightly. The composite motions of the left hand, therefore, produce slight neck extension, mandibular elevation, and gentle downward pressure on the face mask.
B. When a Cervical Spine Injury Is Suspected

1. The operator stands in the same position, and an oropharyngeal or nasopharyngeal airway is inserted, if possible.
2. Successful manual ventilation occasionally can be accomplished while the neck is stabilized in a cervical collar (Figure 2-4). Most often, however, an assistant is required to stand to the side, facing the patient. The anterior portion of the collar is removed, and the assistant places one hand or arm along each side of the neck to limit movement of the neck during manipulation of the airway. Linear traction is not applied.
3. The operator then proceeds with the steps described above, except the left wrist is not rotated to produce neck extension. Alternatively, the operator may choose the two-handed method for mask placement, which further assures that no neck movement occurs. This method is discussed below.

Figure 2-4. Cervical Stabilization
C. Alternative Two-Handed Method to Ensure Airway Patency and Mask Application

The alternative two-handed method is useful if the patient has a large face or a beard, after neck injury, or in any other situation when a mask seal is difficult to secure.

1. The operator stands at the head of the bed as before, and adjunctive airway devices are used as previously suggested.
2. The base and apex of the mask are placed in the manner previously described.
3. The operator places the third, fourth, and fifth fingers of both hands along the mandible on each side of the face while the thumbs rest over the apex of the mask and first fingers rest over the base of the mask.
4. Soft tissues of the cheek are brought upward along the side edges of the mask and held in place by each hand to reinforce the mask’s seal.
5. In the absence of possible cervical spine injury, the neck is slightly extended as the operator gently elevates the mandible from both sides and provides gentle pressure on the mask over the face.
6. An assistant provides ventilation, as needed, by compressing the resuscitation bag.

D. Compression of the Resuscitation Bag to Provide Assisted Manual Mask Ventilation

The goal of manual mask ventilation is to provide adequate minute ventilation, the product of the tidal volume delivered during each resuscitation bag compression and the number of compressions per minute. Overzealous resuscitation bag compressions at a rapid rate may produce dangerous hyperventilation and respiratory alkalemia, as well as gastric distension.

1. If a single-handed method of mask placement is used, the resuscitation bag is compressed over 1 second by the operator’s right hand.
2. The delivered tidal volume must be estimated from the observed chest expansion and auscultated breath sounds.
3. During bag compression, the operator should listen carefully for any gas leaks around the mask. When a good seal is achieved, the feel of the bag during lung inflation reflects some resistance caused by the normal airway anatomy. If gas is moving from the bag too easily, a leak is likely to be present.
4. If the patient is apneic but has a pulse, one-handed bag compressions should be delivered 10 to 12 times per minute. If spontaneous breathing is present, bag compression should be synchronized with the patient’s inspiratory efforts. If the patient is breathing easily and inhaling adequate tidal volumes frequently enough to produce sufficient minute ventilation, the bag need not be compressed at all.
5. Oxygen (100%) is delivered to the resuscitation bag, usually at a flow rate of 15 L/min.
6. If the mask-to-face seal is not adequate and a leak is detected, the operator should consider the following interventions:

- Reposition the mask and hands.
- Adjust the inflation of the facial cushion of the face mask, if possible, to improve the seal or change to a larger or smaller mask.
- Apply slightly more downward pressure to the face or displace the mandible in an upward fashion, provided cervical spine manipulation is not contraindicated.
- Convert to the two-handed technique described earlier.
- Reposition any orogastric or nasogastric tube to another part of the mask. Leaks are common when a tube is present, but rarely will it need to be removed.
- Consider compensating for a small leak by increasing the frequency of bag compressions or the volume of gas delivered in each compression.
- If the resuscitation bag has a pressure-relief (pop-off) valve designed to prevent transmission of high pressures to the lungs, adjust the pop-off valve to ensure adequate tidal volumes in patients with stiff lungs or high airway resistance.

Manual assisted ventilation should be continued in preparation for intubation or until the cause of inadequate ventilation is reversed. An assistant should prepare medications and equipment for intubation while the primary operator maintains ventilation. Pulse oximetry and cardiac monitoring are valuable adjuncts throughout assisted ventilation. The patient should be evaluated continuously for evidence of cyanosis, although this is a late finding in the setting of hypoxemia.

The SOAP ME mnemonic is helpful in preparation for airway management (Table 2-1).
Table 2-1  SOAP ME: Mnemonic for Preparation for Airway Management

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>1. Suction</strong></td>
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<tr>
<td>a. Use a suction device (Yankauer or catheter) to clear secretions, as needed.</td>
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<tr>
<td>b. Check device and tubing for adequate suction strength.</td>
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<td><strong>2. Oxygen</strong></td>
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<tr>
<td>a. Assure oxygen is connected and functioning.</td>
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<td>b. Prepare a bag-valve-mask device with a PEEP valve.</td>
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<td>c. Continue high flow supplemental oxygen by nasal cannula or face mask.</td>
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<td><strong>3. Airways</strong></td>
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<tr>
<td>a. Prepare appropriately sized cuffed endotracheal tube(s) with stylet. Consider size 7-7.5 for females, and size 7.5-8 for males. Check cuff for leaks.</td>
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<tr>
<td>b. Consider airway adjuncts.</td>
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<tr>
<td>i. Oropharyngeal and/or nasopharyngeal airways</td>
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<tr>
<td>ii. Laryngeal mask airways</td>
<td></td>
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<tr>
<td>iii. Esophageal-tracheal double-lumen airway device</td>
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<tr>
<td><strong>4. Position</strong></td>
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<tr>
<td>a. Adjust the bed height for airway operator’s comfort.</td>
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<tr>
<td>b. Place patient in sniffling position. Align the external auditory canal with the sternal notch.</td>
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<tr>
<td>c. Consider elevating the back and shoulders of obese patients.</td>
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<td><strong>5. Monitoring and Medications</strong></td>
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<tr>
<td>a. Continual monitoring of vital signs, including oximetry and end-tidal CO₂.</td>
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<tr>
<td>b. Consider induction drugs (consider rapid sequence induction)</td>
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<tr>
<td>i. Hypnotic</td>
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<td>ii. Neuromuscular blocking agent</td>
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<td>iii. Postintubation sedation and analgesia</td>
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<td><strong>6. Equipment</strong></td>
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<tr>
<td>a. Laryngoscope(s) with curved and/or straight blades (MAC 3,4; Miller 2,3)</td>
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<tr>
<td>b. Optical or video laryngoscope (with appropriate stylets)</td>
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<tr>
<td>c. Bougie and/or airway exchange catheter</td>
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<tr>
<td>d. End-tidal CO₂ detector, if continual end-tidal CO₂ monitoring not available</td>
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<tr>
<td>e. Endotracheal tube fastener or tape to secure endotracheal tube</td>
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Abbreviation: PEEP, positive end-expiratory pressure
Cricoid pressure (Sellick maneuver) is the application of downward (posterior) pressure on the anterior neck overlying the cricoid cartilage, with an intended effect of physical occlusion of the esophagus. Cricoid pressure has been recommended for use during mask ventilation and intubation of patients who lack protective airway reflexes and during rapid sequence intubation. New guidelines no longer recommend cricoid pressure, except as a means of positioning the glottis for better visualization during laryngoscopy. It does not reduce risk of aspiration as previously thought. Proper application of cricoid pressure may improve vocal cord visualization. Excess pressure can compress the trachea and hypopharynx, compromise mask ventilation, and increase the difficulty of endotracheal intubation. Guidelines for managing the difficult airway, whether identified or unrecognized, are presented in Figure 2-5.

**Figure 2-5. Management of the Difficult Airway**

Abbreviations: LMA, laryngeal mask airway

*Airway adjuncts: LMA; esophageal-tracheal-double-lumen airway
V. AIRWAY ADJUNCTS

In approximately 5% of the general population, manual mask ventilation is difficult or impossible to achieve. Predictors of difficulty are the presence of a beard, absence of teeth, history consistent with obstructive sleep apnea, body mass index greater than 26 kg/m², and age older than 55 years. The presence of two predictors indicates a high probability of difficulty in manual mask ventilation. Intubation via direct laryngoscopy is difficult in approximately 5% of the general population and impossible in 0.2% to 0.5%. A crisis situation occurs when manual mask ventilation and intubation are impossible. The laryngeal mask airway and esophageal-tracheal double-lumen airway device are useful adjuncts to provide an open airway and permit gas exchange in such situations. These devices are inserted blindly and their use may offer additional time after a failed intubation attempt. The choice of device depends on the operator’s experience, equipment availability, and specific clinical circumstances.

A. Laryngeal Mask Airway

A laryngeal mask airway is a tube attached to a bowl-shaped cuff that fits in the pharynx behind the tongue. The standard type is reusable, but a single-use device is also available. A laryngeal mask airway may be used to ventilate the lungs when mask ventilation is difficult, provided that the patient does not have periglottal abnormalities. It may also serve as a conduit for intubation when a bronchoscope is used or as a rescue technique after failure to intubate. Less sedation is required with the laryngeal mask airway than with direct laryngoscopy because stimulation to the airway (eg, gagging, laryngospasm, sympathetic stimulation) in passing the device is only moderate. It is effective in ventilating patients ranging from neonates to adults, but it does not provide definitive airway protection. (For specific details regarding use of a laryngeal mask airway, see Appendix 2.)

B. Esophageal-Tracheal Double-Lumen Airway Device

Another tool for providing an emergency airway is a double-lumen device with two inflatable balloon cuffs. Although this item was designed primarily for blind intubation during cardiorespiratory arrest, it can provide ventilation if the distal cuffed portion of the tube device is inserted in the esophagus or trachea. Its use is contraindicated for patients with central airway obstruction, intact laryngeal or pharyngeal reflexes, known esophageal pathology, or ingestion of caustic substances. Adequate training is required to ensure appropriate use. (For information about inserting an esophageal-tracheal double-lumen airway device, see Appendix 2.)
VI. ENDOTRACHEAL INTUBATION

Direct laryngoscopy with orotracheal intubation is the principal method for tracheal intubation because of its speed, success rate, and availability of equipment. Blind nasotracheal intubation may be useful for selected patients. The indications for tracheal intubation are summarized in Table 2-2, and the techniques for orotracheal and nasotracheal intubation are discussed and illustrated in Appendix 3.

<table>
<thead>
<tr>
<th>Table 2-2</th>
<th>Indications for Tracheal Intubation</th>
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<tr>
<td>Airway protection</td>
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<tr>
<td>Relief of obstruction</td>
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<tr>
<td>Provision of mechanical ventilation and oxygen therapy</td>
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<td>Respiratory failure</td>
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<tr>
<td>Shock</td>
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<tr>
<td>Hyperventilation for intracranial hypertension</td>
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<tr>
<td>Reduction of the work of breathing</td>
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<tr>
<td>Facilitation of suctioning/pulmonary toilet</td>
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</table>

In preparation for intubation, important issues include:

- Assessment of airway anatomy and function to estimate degree of difficulty for intubation (discussed later).
- Assurance of optimal ventilation and oxygenation. Preoxygenation with 100% oxygen, using a bag-mask resuscitation device, occurs during periods of apnea and before intubation attempts.
- Decompression of the stomach with an existing orogastric or nasogastric tube. However, the insertion of such tube to decompress the stomach prior to intubation is often counterproductive, as it may elicit emesis and promote passive reflux of gastric contents.
- Provision of appropriate analgesia, sedation, amnesia, and neuromuscular blockade as required for a safe procedure (discussed later).

Although emergent intubation leaves little time for evaluation and optimization of conditions, elective and urgent intubation allows for assessment of factors that promote safe airway management. The patient's clinical situation, intravascular volume status, hemodynamics, and airway evaluation (degree of difficulty) should be assessed as a plan for airway management is formulated. Airway evaluation includes assessment of physical characteristics that together determine if visualization of the vocal cords will be difficult or impossible. This evaluation will suggest whether alternative techniques to direct laryngoscopy (eg, video laryngoscopy, awake
Airway Management

intubation, flexible fiberoptic intubation, surgical airway) are likely to be necessary and whether a more experienced individual should be summoned immediately. Keep in mind that many of these physical characteristics also cause difficulty with mask ventilation and the ability to perform an emergent cricothyrotomy. These characteristics are easy to remember if they are considered in the same order as the steps used in oral intubation — that is, head position, mouth opening, displacement of the tongue and jaw, visualization, and insertion of endotracheal tube:

- **Neck mobility.** The presence of possible cervical spine injury, short neck, or limited neck mobility due to prior surgery or arthritis will restrict the ability to position adequately. If there is a possibility of cervical spine injury, neck extension should be avoided and an appropriately sized cervical collar should be placed for cervical motion restriction (Figure 2-4).

- **External face.** The patient should be examined for evidence of a small mandible or the presence of surgical scars, facial trauma, small nares, or nasal, oral, or pharyngeal bleeding.

- **Mouth.** Mouth opening may be limited due to temporomandibular joint disease or facial scarring. An opening of less than three finger breadths (approximately 6 cm) is associated with an increased risk of difficult intubation.

- **Tongue and pharynx.** Tongue size relative to the posterior pharynx provides an estimate of the amount of room in the pharynx to visualize glottic structures.

- **Jaw.** Thyromental distance is the distance in finger breadths between the anterior prominence of the thyroid cartilage (Adam’s apple) and the tip of the mandible (chin), and is an estimate of the length of the mandible and the available space anterior to the larynx. A distance of less than three finger breadths (approximately 6 cm) indicates that the larynx may appear more anterior and be more difficult to visualize and enter during laryngoscopy. A more acute angulation of the stylet at the distal end of the endotracheal tube may be helpful (see above).

If one or a combination of these physical characteristics indicates the possibility of difficult intubation and if time allows, other options for obtaining a secure airway and summoning someone with additional airway expertise should be considered.

When difficulty in mask ventilation or intubation is anticipated, care is advised before suppressing spontaneous ventilation with neuromuscular blocking drugs or sedatives that cannot be reversed. Video laryngoscopy has shown to be an effective method of airway management as both a primary intubation technique and in management of the difficult airway. Options for safe airway management include the following, all of which preserve spontaneous ventilation:

- **Awake intubation by direct or video laryngoscopy, or blind nasotracheal intubation**

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![Failed intubation attempts can result in periglottic edema and create subsequent difficulty with mask ventilation, leading to a “can’t intubate and can’t ventilate” situation.](image)
Flexible fiberoptic intubation (expert consultation required)

Awake tracheostomy (expert consultation required)

In the event that visualization of the glottis and mask ventilation are both impossible and there is no spontaneous ventilation, options include:

- Laryngeal mask airway or esophageal-tracheal double-lumen airway device
- Needle cricothyrotomy (expert consultation required)
- Surgical cricothyrotomy/tracheostomy (expert consultation required)
- Percutaneous tracheostomy (expert consultation required)

An algorithm for managing a potential or confirmed difficult airway is shown in Figure 2-5.

After tracheal intubation, significant alterations in hemodynamics should be anticipated. Hypertension and tachycardia may result from sympathetic stimulation, and some patients may require therapy with antihypertensive medications or sedatives. Hypotension is common, and decreased cardiac output, due to reduced venous return associated with positive pressure ventilation, can precipitate arrhythmias or cardiac arrest. The effects of sedative agents on the vasculature or myocardium, hypovolemia, and a possible postintubation pneumothorax may also contribute to hypotension. Other complications associated with positive pressure ventilation are discussed in Chapter 5.

VII. PHARMACOLOGIC PREPARATION FOR INTUBATION

During the process of airway management, both parasympathetic and sympathetic responses are common and may require control with proper pharmacologic therapy. The pharmacologic goal before intubation is to provide the patient with optimal analgesia/anesthesia, amnesia, and sedation without altering cardiopulmonary stability. At times, preservation of spontaneous ventilatory drive is necessary. The selection of particular methods or drugs depends upon the clinical circumstances and the patient’s status, patient allergies, and the experience and preferences of the operator.

A. Analgesia/Anesthesia

- A variety of topical anesthetic sprays are available, or lidocaine may be delivered via an aerosol. Anatomic areas for special emphasis include the base of the tongue, directly on the posterior wall of the pharynx, and bilaterally in the tonsillar fossae. Care should be taken not to exceed 4 mg/kg of lidocaine (maximum dose 300 mg), as it is easily absorbed from the airway mucosa.

Excessive use of benzocaine topical sprays can produce clinically significant methemoglobinemia.
■ Administration of nerve blocks and transcrioid membrane lidocaine requires special expertise outside the scope of this course.

■ Some sedative agents also have analgesic properties; most do not.

B. Sedation/Amnesia

Rapid-acting, short-lived, and potentially reversible agents are preferred for sedation. No single agent has every desirable feature, and often more than one agent may be considered to provide a balanced technique. The status of the patient’s intravascular volume and cardiac function must be carefully considered during the selection of an agent and its dosage. Most may induce hypotension when heart failure or hypovolemia is present. Examples of commonly used medications are listed in Table 2-3. Be prepared to manage hypotension following induction with fluid boluses and/or vasopressors (Chapters 5 and 7).

C. Neuromuscular Blockers

Often, intubation can be safely and easily performed after topical anesthesia (ie, an awake intubation), or with sedation alone. Therefore, neuromuscular blockade is not always required before endotracheal intubation. Obviously, if the operator cannot intubate the patient after neuromuscular blockers have been given, effective manual mask ventilation must be continued while a more experienced person is sought, an alternative plan to secure the airway is developed, or the agent is metabolized with return of spontaneous ventilation. Hence, a short-acting agent is advantageous. The following are examples of neuromuscular blockers:

■ Succinylcholine, 1 to 1.5 mg/kg intravenous bolus: rapid onset; shortest duration, which provides an element of safety; may cause muscle fasciculations because this agent depolarizes skeletal muscle; emesis may occur if abdominal muscle fasciculations are severe; contraindicated when ocular injury is present; relatively contraindicated when head injury or hyperkalemia is present (potassium release of 0.5-1 mmol/L will occur routinely, and massive potassium release may occur in burn and crush injury, upper motor neuron lesions, or primary muscle disease); may precipitate malignant hyperthermia. Effects are prolonged in patients with atypical cholinesterase or decreased pseudocholinesterase levels.

■ Vecuronium, 0.1 to 0.3 mg/kg; rocuronium, 0.6 to 1 mg/kg; or cisatracurium, 0.1 to 0.2 mg/kg intravenous bolus: no fasciculations because these are nondepolarizing agents; slower onset of muscle paralysis; significantly longer duration of effects than with succinylcholine.
### Table 2-3 Drugs Used to Facilitate Tracheal Intubation

<table>
<thead>
<tr>
<th>Agent</th>
<th>Dosing</th>
<th>Benefits</th>
<th>Cautions</th>
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<tbody>
<tr>
<td>Fentanyl</td>
<td>0.5-2 μg/kg IV bolus every several minutes titrated to analgesic effect</td>
<td>Rapid onset of action, Short acting, Reversible with naloxone</td>
<td>Chest wall rigidity with rapid administration, Respiratory depression, Does not inhibit patient awareness of procedure</td>
</tr>
<tr>
<td>Midazolam</td>
<td>0.1-0.3 mg/kg bolus titrated to sedative effect every several minutes</td>
<td>Provides amnesia, Rapid onset of action, Short acting, Reversible with flumazenil</td>
<td>Additive respiratory depression when combined with narcotic, Does not provide analgesia</td>
</tr>
<tr>
<td>Etomidate</td>
<td>0.1-0.3 mg/kg single IV bolus</td>
<td>Provides hypnosis, May be preferred in head injury, No adverse cardiovascular effects</td>
<td>May induce myoclonus, including mild trismus (consider premedication with 50 μg fentanyl), No reversal agent, Transient adrenal suppression</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>1-1.5 mg/kg IV bolus 2-3 minutes before laryngoscopy</td>
<td>Blunts hemodynamic and tracheal response to intubation, May reduce elevations of intracranial pressure during laryngoscopy</td>
<td>Should not exceed 4 mg/kg total dose due to neurotoxicity (seizures)</td>
</tr>
<tr>
<td>Ketamine</td>
<td>1-4 mg/kg IV bolus</td>
<td>Rapid onset, No adverse cardiovascular effects (except in severe congestive heart failure), Short acting</td>
<td>May increase intracranial pressure, May result in hallucinations upon emergence, Consider small dose of benzodiazepine (midazolam 0.5-1 mg IV) as an adjunct</td>
</tr>
<tr>
<td>Propofol</td>
<td>1-2 mg/kg IV bolus</td>
<td>Rapid onset, Short acting, Provides amnesia</td>
<td>Severe hypotension in volume-depleted patients, Does not provide analgesia, Respiratory depression</td>
</tr>
</tbody>
</table>

The medications and doses listed are for induction in intubation in adult patients and are not intended for ongoing sedation or pain control.

### D. Rapid Sequence Intubation

Rapid sequence intubation is the simultaneous administration of a sedative agent and a neuromuscular blocker, designed to facilitate intubation and reduce the risk of gastric aspiration. It is the technique of choice when there is an increased risk of aspiration (eg, full stomach, pain, gastroesophageal reflux) and examination does not suggest a difficult intubation. Patients in whom intubation is likely to be difficult should not have rapid sequence intubation. The emergency methods described earlier will be necessary if the patient cannot be intubated and is impossible to ventilate, because the ability to ventilate via mask is not tested before administration of the neuromuscular blocker.
E. Intracranial Pressure

Intracranial pressure may rise during laryngoscopy and intubation, and this may be harmful in patients with preexisting intracranial hypertension. Intravenous lidocaine (1-1.5 mg/kg) has been shown to blunt this response and should be administered before laryngoscopy when intracranial pathology is suspected.

Airway Management

- Assessment of the patient’s level of consciousness, airway protective reflexes, respiratory drive, obstruction(s) to gas flow into the airway, and work of breathing will determine the steps necessary to ensure appropriate respiratory support.

- Every primary care provider must be skilled in manual methods to secure and maintain a patent airway.

- Manual assisted ventilation performed with a bag-mask resuscitation unit is a skill expected of every healthcare provider. The goal is to optimize oxygenation and CO₂ removal before, or in lieu of, intubation of the patient.

- Proper application of cricoid pressure may reduce the risk of gastric distension and passive aspiration.

- The laryngeal mask airway and esophageal-tracheal double-lumen airway device are useful airway adjuncts when expertise in intubation is lacking or intubation is unsuccessful.

- Before intubation, patient evaluation is necessary to assess the degree of difficulty and determine the appropriateness of analgesia, sedation, amnesia, and possible neuromuscular blockade.

- A plan for managing a potentially difficult intubation includes maintenance of spontaneous ventilation, video laryngoscopy, alternatives to endotracheal intubation, and requests for expert assistance. When manual mask ventilation is impossible after failed intubation, proper use of adjunct devices, cricothyrotomy, or percutaneous tracheostomy may be lifesaving.

Suggested Readings

Current and updated resources for this chapter may be accessed by visiting http://www.sccm.me/fccs6.


**Suggested Website**