OPTIONAL SKILL 1: Digital Intubation

Objectives

Upon completion of this Skill Station, you should be able to:

1. Discuss the indications for performing digital intubation.
2. Perform digital intubation.

The original method of endotracheal intubation, quite widely known in the 18th century, was the “tactile” or “digital” technique. The intubator merely felt the epiglottis with the fingers and slipped the endotracheal tube distally through the glottic opening. Recently, the technique has been refined and demonstrated to be of use for a wide variety of patients, particularly in the rescue and tactical medical environment. The single-lumen blind-insertion supraglottic tubes (King LT-D Airway and Laryngeal Mask Airway) also are useful for those situations.

INDICATIONS

Digital orotracheal intubation is useful for deeply comatose or cardiac-arrest patients who

- Are difficult to position properly for direct laryngoscopic visualization
- Are somewhat inaccessible to the full view of the rescuer
- May be at risk for cervical-spine injury
- Have facial injuries that distort anatomy
- Have copious oropharyngeal bleeding or secretions that render visualization difficult
OPTIONAL SKILLS

You may prefer to perform digital intubation when you are confident of your ability with this technique or when a laryngoscope fails or is not immediately available. The technique is most valuable in those patients in difficult positions such as extrications and in those who have copious secretions despite adequate attempts at suctioning.

EQUIPMENT

Digital intubation requires the following equipment:

- Endotracheal tube, 7.0-, 7.5-, or 8.0-mm internal diameter
- Malleable stylet (Note: Some prefer to perform the procedure without a stylet.)
- Water-soluble lubricant
- 12-cc syringe
- Dental prod, mouth gag, and so on for placement between the teeth
- Nonlatex gloves

TECHNIQUE

1. Perform routine preparation procedures as taught in Chapter 5.
2. Prepare the tube by inserting the lubricated stylet and bending the tube into an “open J” configuration. The stylet should not protrude beyond the tip of the tube, but it should come to at least the side hole.
3. Apply a water-soluble lubricant liberally to the tip and cuff of the tube.
4. Wear gloves for protection.
5. Kneel at the patient’s left shoulder facing the patient, and place a dental prod or mouth gag between the patient’s molars (Figure 1).
6. “Walk” the index and middle fingers of your left hand down the midline of the tongue, all the while pulling forward on the tongue and jaw. This is a most important maneuver and serves to lift the epiglottis up within reach of the probing fingers.

FIGURE 1 Digital intubation. Preparing patient with use of mouth (dental) prod to protect the intubator against being bitten.
7. Palpate the epiglottis with your middle finger. It feels much like the tragus of the ear.

8. Press forward on the epiglottis and slip the tube into the mouth at the left corner of the mouth (Figure 2). Use the index finger to keep the tube tip against the side of the middle finger (which is still palpating the epiglottis). This guides the tip to the epiglottis. You also can use the side hole of the tube as a landmark to ensure that you are always aware of the position of the tip of the endotracheal tube. This is a crucial principle of the technique.

9. Guide the tube tip to lie against the epiglottis using the middle and index fingers. The epiglottis is in front and the fingers behind. Advance the tube distally through the cords using the right hand. Press forward with the index and middle fingers of the left hand to prevent the tube from slipping posteriorly into the esophagus. Note: At this point the tube–stylet combination may encounter resistance, especially if the distal curve of the tube is sharp. This usually means that the tube tip is pressing on the anterior wall of the thyroid cartilage. Pulling back slightly on the stylet will allow the tube to conform to the anatomy, and the tube should slip into the trachea.

10. Confirm placement by the confirmation protocol taught in Chapter 5.

**OPTIONAL SKILL 2: Transillumination (Lighted Stylet)**

**Objectives**

*Upon completion of this Skill Station, you should be able to:*

1. Describe the advantages of this technique.
2. Perform endotracheal intubation by the transillumination method.

The transillumination or lighted stylet method of endotracheal intubation is based on the fact that a bright light inserted inside the upper airway can be seen through the soft tissues of the neck when inside the larynx or trachea. This permits you to guide the tube tip through the glottic opening without directly visualizing the cords. It has been called the “indirect visual” method and has been
shown in several studies to be reliable, quick, and atraumatic. It is particularly attractive in trauma patients because it appears to move the head and neck less than conventional orotracheal methods.

**EQUIPMENT**

- **Stylet.** The lighted stylet (Figure 3) is a malleable wire connecting a proximal battery housing to a distal lightbulb, covered with a tough plastic coating that prevents the light from being separated from the wire. An on/off switch is located at the proximal end of the battery housing.
- **Endotracheal tubes.** All tubes should have an internal diameter of 7.5 to 8.5 mm.
- **Other equipment** will be standard to any intubation procedure: suction, oxygen, gloves, lubricant, and so on.

**TECHNIQUE**

The success of the transillumination method depends on several factors. They are as follows:

- **Level of the ambient light.** The light should be cut down to about 10% of normal, or the patient’s neck should be shielded from direct sun or bright daylight. Although the transilluminated light can be seen in thin patients even in daylight, success will be more likely in darker surroundings. Because control of daylight is impossible, this technique is best used at night.
- **Pulling forward on the tongue**—or tongue and jaw—lifts the epiglottis up out of the way. This is essential to the method (Figure 4).
- **Bend of the tube—stylet.** Bend the tube—stylet combination just proximal to the cuff. A bend that is too far proximal will cause the tube to strike against the posterior pharyngeal wall and prevent the tube from advancing anteriorly.
through the glottic opening (Figure 4). Slip the lubricated stylet into the tube and hold firmly against the battery housing while bending the tube–stylet. Bend the tube–stylet more sharply if the patient is not in the sniffing position.

To perform the transillumination or lighted stylet method of endotracheal intubation, perform the following steps:

1. Perform routine preparation procedures taught in Chapter 5.
2. Stand or kneel on either side facing the patient’s head. Wear gloves for the procedure. Switch on the light.
3. Grasp the patient’s tongue—or more easily, the tongue and jaw—and lift gently forward while slipping the liberally lubricated tube–stylet combination down the tongue.
4. Using a “soup ladle” motion, “hook” up the epiglottis with the tube–stylet. The transilluminated light can then be seen in the midline. Correct placement at or beyond the cords is indicated by the appearance of a circumscribed area of light at the level of the laryngeal prominence (Figure 5). A dull glow, diffuse and difficult to see, indicates esophageal placement (Figure 6).
5. When you see the light, hold the stylet firmly in place and use the fingers of your other hand to support the tube as you advance the tube off the stylet and more distally into the larynx.
6. Confirm placement of the tube with the confirmation protocol taught in Chapter 5.
OPTIONAL SKILL 3: Translaryngeal Jet Ventilation

Objectives

Upon completion of this Skill Station, you should be able to:

1. Discuss the indications for this procedure.
2. Perform translaryngeal jet ventilation (TLJV).

When the airway cannot be maintained because of obstruction or partial obstruction above the cords, access below the level of the cords is needed. Translaryngeal jet ventilation (TLJV) provides a quick, reliable, and relatively safe method of adequate oxygenation and ventilation, especially in the trauma patient. Many misconceptions and erroneous impressions persist about this technique, and the medical literature is in a state of flux on the subject. Clinical experience and studies done using appropriate equipment in both animals and patients clearly indicate the following:

- Patients can be both oxygenated and ventilated with this technique, which delivers 100% oxygen in volumes exceeding 1 liter per second.
- Ventilation can proceed indefinitely, providing the correct size cannula is used with the proper driving pressure.
- Cannula of 14 gauge or larger with side holes must be used.
- Driving pressures of at least 50 psi (30 psi in a small child) must be used to deliver sufficient volumes to ensure adequate ventilation.

You cannot ventilate patients using small-bore cannulae with continuous-flow oxygen attached. The foregoing principles must be adhered to if you are to safely and effectively use this technique.
EQUIPMENT

The tools needed for TLJV should be prepared well in advance and stored in a small bag or kit. They include the following:

- **No. 14 or 13-gauge cannula, with side holes (Figure 7).** Those sizes are the minimum necessary for adequate ventilation. Side holes are especially important because they prevent the cannula from remaining against the tracheal wall and subjecting it to sudden pressures that could rupture it.

- **Manual jet ventilator device.** This device is commercially available and is merely a valve that allows high-pressure oxygen to flow through it when a button is pushed. It should have high-pressure tubing attached solidly with special fasteners and tape.

- **Wrench.** A small wrench should be attached to the jet ventilator tubing so that you lose no time looking for a way to tap into the oxygen tank or turn it on.

TECHNIQUE

Identification of the cricothyroid membrane is essential to this technique, although placement between the tracheal rings probably would not result in major complications.

1. While continuing attempts at ventilation and oxygenation, puncture the cricothyroid membrane with the cannula to which is attached a 5-cc syringe filled with 1 to 2 cc of saline (Figure 8). Note: Several cubic centimeters of 2% lidocaine can be used instead of saline to produce local anesthesia of the mucosa in the area of the distal port of the cannula.

2. Direct the cannula downward, continually aspirating to promptly demonstrate entry into the larynx, identified when you aspirate bubbles of air. At this point, if lidocaine is contained in the syringe, you can inject it into the larynx to provide some anesthesia and to prevent the coughing that sometimes occurs.
3. When the cannula enters the larynx, slide the cannula off the needle trochar and hold it in place while the TLJV is connected to the proximal port of the cannula (Figure 9).

4. Immediately ventilate the patient using 1- to 5-second bursts of oxygen from the 50-psi manual source. Ventilate at a rate of at least 20 per minute; that is, an inspiratory/expiratory ratio of 1:2 (Figure 10). Monitor with capnography if available.

5. If a tie is available, fix the cannula in place. Tape also can be used, but you must fasten it firmly to the cannula and then around the patient’s neck. Apply firm pressure at the site of insertion to reduce the small amount of subcutaneous emphysema that usually occurs with this technique.
OPTIONAL SKILL 4: Esophageal Tracheal Combitube

Objectives

Upon completion of this Skill Station, you should be able to:

1. Explain the five essential points about use of this airway.
2. Correctly insert the Combitube.

Introduced in the early 1970s, blind insertion airway devices (BIADs) were designed for use by EMS personnel who were not trained to intubate the trachea. All those devices (Combitube, Rusch Easy Tube, and King LT-D airway) were designed to be inserted into the pharynx without the need for a laryngoscope to visualize where the tube is going. They all have a tube with an inflatable cuff that is designed to seal the esophagus, thus preventing vomiting and aspiration of stomach contents, as well as preventing gastric distention during bag-mask or demand-valve mask ventilation. It also was thought that by sealing the esophagus, more air would enter the lungs and ventilation would be improved. The devices have their own dangers and require careful evaluation to be sure that they are in the correct position. This class of airway is now referred to as supra-glottic airways. None of the BIADs are equal to the endotracheal tube, which has become the invasive airway of choice for advanced EMS providers.

The Combitube has a double lumen. The two lumens are separated by a partition. (See Figure 11.) One tube is sealed at the distal end, and there are perforations in the area of the tube that would be in the pharynx. When the long tube is in the esophagus, the patient is ventilated through this short tube. The long tube is open at the distal end, and it has a cuff that is blown up to seal the esophagus or the trachea, depending on which it has entered. When inserted, if the long tube goes into the esophagus, the cuff is inflated, and the patient is ventilated through the short tube. If the long tube goes into the trachea, the cuff is inflated, and the patient is ventilated through the long tube.

FIGURE 10 Patient is ventilated indefinitely with 1- to 5-second bursts of oxygen from a 50-psi source at a rate of 20/min.

FIGURE 11 Esophageal placement of the Combitube—ventilate through tube 1.
This device has a pharyngeal balloon that seals the pharynx and prevents blood and mucus from entering the airway from above. As with the other BIADs, you must be sure that you are ventilating the lungs and not the stomach.

**ESSENTIAL POINTS**
You must remember five essential points about the Combitube. They are as follows:

- Use the Combitube only in patients who are unresponsive and without protective reflexes.
- Do not use it in any patient with injury to the esophagus (e.g., caustic ingestions) or in children who are below the age of 15 and of average height and weight.
- Pay careful attention to proper placement. Unrecognized intratracheal placement of the long tube is a lethal complication that produces complete airway obstruction. Such an occurrence is not always easy to detect, and the results are catastrophic. One of the great disadvantages of this airway is the fact that you can determine correct placement only by auscultation and observation of chest movement, and both may be quite unreliable in the prehospital setting. Use of capnography to confirm airway placement and monitor position of the airway is recommended.
- You must insert the tube gently and without force.
- If the patient regains consciousness, you must remove the Combitube, because it will cause retching and vomiting.

**TECHNIQUE**
1. With the neck stabilized in a neutral position, insert the tube blindly, watching for the two black rings on the Combitube that are used for measuring the depth of insertion. The rings should be positioned between the teeth and the lips (Figure 11).
2. Use the large syringe to inflate the pharyngeal cuff with 100 cc of air. When inflated, the Combitube will seat itself in the posterior pharynx behind the hard palate.
3. Use the small syringe to fill the distal cuff with 10 to 15 cc of air.
4. The long tube usually will go into the esophagus. Ventilate through the esophageal connector. It is the external tube that is the longer of the two and is marked “no. 1.” You must see the chest rise, hear breath sounds, feel good compliance, and hear no breath sounds over the epigastrium to be sure that the long tube is in the esophagus.
5. If you do not see the chest rise, hear breath sounds, and feel good compliance, and if you hear breath sounds over the epigastrium, the tube has been placed in the trachea (Figure 12). In this case, change the ventilator to the shorter tracheal connector, which is marked “no. 2.” Again you must check to see the chest rise, hear breath sounds, feel good compliance, and hear no breath sounds over the epigastrium to be sure that you are ventilating the lungs.

Like the other BIADs, if the patient becomes conscious, you must remove the Combitube. Extubation is likely to cause vomiting, so be prepared to suction the pharynx and turn the backboard.
OPTIONAL SKILL 5: King LT-D Airway

Objectives

Upon completion of this Skill Station, you should be able to:

1. Explain the six essential points about use of this airway.
2. Correctly insert the KING LT-D airway.

Introduced in the early 1970s, blind insertion airway devices (BIADs) were designed for use by EMS personnel who were not trained to intubate the trachea. All those devices (Combitube, Rusch Easy Tube, and KING LT-D airway) were designed to be inserted into the pharynx without the need for a laryngoscope to visualize where the tube is going. All of them have a tube with an inflatable cuff that is designed to seal the esophagus, thus helping to prevent vomiting and aspiration of stomach contents, as well as preventing gastric distention during bag-mask or demand-valve mask ventilation. It also was thought that by sealing the esophagus, more air would enter the lungs and ventilation would be improved. The devices have their own dangers and require careful evaluation to be sure that they are in the correct position. This class of airway is now referred to as supraglottic airways. None of the BIADs are equal to the endotracheal tube, which has become the invasive airway of choice for advanced EMS providers.

The KING LT-D airway differs from the Combitube in that it has a single lumen (Figure 13). Once the tube is inserted into the esophagus, both the esophageal and pharyngeal cuffs are inflated, and the patient is ventilated through the single tube. With the airway in place you may be able to insert a bougie or a fiberoptic bronchoscope through the ventilating tube and swap the airway for an endotracheal tube, though it is not always successful. There is also an LTS-D airway that has a port through which you can insert a gastric tube to decompress the stomach. It is inserted in exactly the same way as the LT-D airway. The KING LT-D airway is quicker and easier to insert than the Combitube but, as
OPTIONAL SKILLS

with the other BIADs, you must be sure that you are ventilating the lungs and not the stomach. The King LT-D comes in five sizes for patients greater than six feet tall down to 35 inches.

ESSENTIAL POINTS

You must remember six essential points about the King LT-D airway. They are as follows:

■ Use the KING LT-D airway only in patients who are unresponsive and without protective reflexes.
■ Do not use it in any patient with injury to the esophagus (e.g., caustic ingestions) or in children who are below the age of 15 and of average height and weight.
■ Do not use it in patients who are less than 35 inches tall.
■ Pay careful attention to proper placement. Unrecognized intratracheal placement of the tube is a lethal complication that produces complete airway obstruction. Such an occurrence is not always easy to detect, and the results are catastrophic. Capnography is recommended for confirmation of tube placement.
■ You must insert it gently and without force.
■ If the patient regains consciousness, you must remove the airway because it will cause retching and vomiting.

TECHNIQUE

1. Select the correct size KING LT-D airway.
   • Size 2 (green connector color) is for children 35 to 45 inches in height (or 12–25 kg).
   • Size 2.5 (Orange connector color) is for children 41 to 51 inches feet in height (or 25–35 kg).
   • Size 3 (yellow connector color) is for adults 4 to 5 feet in height.
   • Size 4 (red connector color) is for adults 5 to 6 feet in height.
   • Size 5 (purple connector color) is for adults greater than 6 feet in height.
2. Test cuff inflation system for air leak.
3. Apply water-soluble lubricant to the distal tip.
4. Hold the airway at the connector with your dominant hand. With the neck stabilized in a neutral position, hold the mouth open and apply a chin lift with your nondominant hand. Using a lateral approach, introduce the tip into the mouth (Figure 14).
5. Advance the tip behind the base of the tongue while rotating the tube back to the midline so that the blue orientation line faces the chin of the patient (Figure 15).
6. Without exerting excessive force, advance the tube until the base of the connector is aligned with the patient’s teeth or gums (Figure 16).
FIGURE 15  Advance the tip behind the base of the tongue while rotating the tube back to the midline so that the blue orientation line faces the chin of the patient.

FIGURE 16  Gently advance the tube until the base of connector is aligned with teeth or gums.
7. Hold the KLT 900 Cuff Pressure Gauge in nondominant hand, and inflate the cuffs of the KING LT-D with air to a pressure of 60 cm H₂O (Figure 17). If a cuff pressure gauge is not available and a syringe is being used to inflate the KING LT-D, inflate cuffs with the minimum volume necessary to seal the airway at the peak ventilatory pressure employed (just seal volume). Typical inflation volumes are as follows:
   - Size 2 (green) = 25–35 mL
   - Size 3 (orange) = 30–40 mL
   - Size 4 (red) = 45–60 mL
   - Size 5 (purple) = 60–80 mL
   - Size 6 (yellow) = 70–90 mL

8. Attach the resuscitator bag to the airway. While bagging the patient, gently withdraw the tube until ventilation becomes easy and free flowing (Figure 18). Adjust cuff inflation if necessary to obtain a seal of the airway at the peak ventilatory pressure employed. You must see the chest rise, hear breath sounds, feel good compliance, and hear no breath sounds over the epigastrium to be
sure that the King LT-D airway is correctly placed. However, this method is unreliable, and thus capnography is recommended for confirming and monitoring the position of the tube.

Like the other BIADs, if the patient becomes conscious, you must remove the airway. Extubation is likely to cause vomiting, so be prepared to suction the pharynx and turn the backboard.

## OPTIONAL SKILL 6: Laryngeal Mask Airway

**Objectives**

*Upon completion of this Skill Station, you should be able to:*

1. Explain the five essential points about use of the airway.
2. Correctly insert the laryngeal mask airway (LMA).

The laryngeal mask airway (LMA) was developed for use as an alternative to the face mask for achieving and maintaining control of the airway during routine anesthetic procedures in the operating room. Because it does not protect the airway against vomiting and aspiration, the LMA was meant to be used in patients who had been fasting and thus had an empty stomach. It was later found to be useful in the emergency situation when intubation is not possible and you cannot ventilate with a bag-mask. It may prevent having to do a surgical procedure to open the airway. The LMA is another supraglottic BIAD but differs from the others in that it was never designed to seal the esophagus and was not originally meant for emergency use. It is not equal to the endotracheal tube and should only be used when efforts to intubate the trachea have been unsuccessful and ventilation is compromised.

### WARNINGS

- Use the LMA only in patients who are unresponsive and without protective reflexes. If the patient still has a gag reflex, the LMA may cause laryngospasm or vomiting.
- Do not use it in any patient with injury to the esophagus (e.g., caustic ingestions) or in children who weigh less than 30 kg.
- Lubricate only the posterior surface of the LMA to avoid blockage of the aperture or aspiration of the lubricant.
- Patients should be adequately monitored (constant visual monitoring, cardiac monitor, and if possible, pulse oximeter) at all times during LMA use.
- To avoid trauma to the airway, force should never be used during LMA insertion.
- Never overinflate the cuff after insertion. Overinflation may cause malposition, loss of seal, or trauma. Cuff pressure should be checked periodically, especially if nitrous oxide is used.
- If airway problems persist or ventilation is inadequate, the LMA should be removed and reinserted or an airway established by other means.
- The LMA does not prevent aspiration if the patient vomits. The presence of a nasogastric tube does not rule out the possibility of regurgitation and
may even make regurgitation more likely because the tube makes the esophageal sphincter incompetent.

- If the patient regains consciousness, you must remove the LMA, as it will cause retching and vomiting.

**TECHNIQUE**

1. With the neck stabilized in a neutral position, ventilate with mouth-to-mask or bag-mask and suction the pharynx before insertion of the airway.

2. Remove the valve tab and check the integrity of the LMA cuff by inflating with the maximum volume of air (Table 1).

3. The cuff of the LMA should be tightly deflated using the enclosed syringe so that it forms a flat oval disk with the rim facing away from the aperture. This can be accomplished by pressing the mask with its hollow side down on a sterile flat surface (Figure 19a). Use the fingers to guide the cuff into an oval shape and attempt to eliminate any wrinkles on the distal edge of the cuff. A completely flat and smooth leading edge facilitates insertion, avoids contact with the epiglottis, and is important to ensure success when positioning the device (Figure 19b).

4. Lubricate the posterior surface of the LMA with a water-soluble lubricant just before insertion.

5. Preoxygenate (do not hyperventilate) the patient.

6. If there is no danger of spinal injury, position the patient with the neck flexed and the head extended. If the mechanism of injury suggests the potential for spinal injury, the head and neck must be maintained in a neutral position.

7. Hold the LMA like a pen, with the index finger placed at the junction of the cuff and the tube (Figure 19c). Under direct vision, press the tip of the cuff upward against the hard palate and flatten the cuff against it (Figure 19d). The black line on the airway tube should be oriented anteriorly toward the upper lip.

8. Use the index finger to guide the LMA, pressing upward and backward toward the ears in one smooth movement (Figure 19e). Advance the LMA into the hypopharynx until definite resistance is felt (Figure 19f).

9. Before removing the index finger, gently press down on the tube with the other hand to prevent the LMA from being pulled out of place (Figure 19g).

10. Without holding the tube, inflate the cuff with just enough air to obtain a seal. The maximum volumes are shown in Table 1.

### Table 1: Cuff Volumes for LMA

<table>
<thead>
<tr>
<th>LMA Size</th>
<th>Patient Size</th>
<th>Maximum Cuff Volumes (Air Only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Children &gt; 30 kg and small adults</td>
<td>20 mL</td>
</tr>
<tr>
<td>4</td>
<td>Normal and large adults</td>
<td>30 mL</td>
</tr>
<tr>
<td>5</td>
<td>Large adults</td>
<td>40 mL</td>
</tr>
</tbody>
</table>
FIGURE 19  Insertion of the laryngeal mask airway.
11. Connect the LMA to the bag-mask and employ manual ventilation of less than 20 cm H₂O. (This precludes use of a flow-restricted oxygen-powered ventilation device [FROPVD] unless you use one that allows you to set the pressure.) As with the BIADs, you must see the chest rise, hear breath sounds, feel good compliance, and hear no breath sounds over the epigastrium to be sure that the LMA is correctly placed. However, this method is unreliable, so use of capnography to confirm and monitor tube position is recommended.

12. Insert a bite block (not an oropharyngeal airway) and secure the LMA with tape (Figure 19h). Remember that the LMA does not protect the airway from aspiration. If the patient becomes conscious, the LMA must be removed. Extubation is likely to cause vomiting; be prepared to suction the pharynx and turn the backboard.

**OPTIONAL SKILL 7: Drug-Assisted Intubation (Formerly Known as Rapid Sequence Intubation [RSI])**

**Objectives**

*Upon completion of this Skill Station, you should be able to:*

1. Discuss the situations where drug-assisted intubation (DAI) can be of benefit to the patient.
2. Discuss the situations were DAI can be detrimental to the patient.
3. Correctly perform DAI.

The importance in appropriately managing the airway of the trauma patient cannot be overemphasized. Loss of airway remains the leading cause of early preventable trauma deaths, and hypoxia has been shown to worsen outcomes for trauma patients, especially those with closed head injury. The indications for active airway management and the options managing the airway are well covered in Chapter 4, and the skills for managing the airway are detailed in Chapter 5 of the text. All responders should be familiar with the materials in those two chapters and be able to apply the care described.

When EMS first obtained the ability to perform endotracheal intubation, it was essentially performed on “dead” patients: unresponsive and apneic. Not all patients fit this situation, and airway management of patients who were agitated, combative, or had airway trauma had to wait until they deteriorated and became unresponsive.

It is important to remember that all airways managed in the field meet the American Society of Anesthesiology’s definition of a “difficult airway.” Thus the responder must have many “tools” in the toolbox available to manage the airway of the trauma patient. Popular in EMS circles, one tool in the toolbox for airway management (one that addresses the problem mentioned earlier) is drug-assisted intubation. The old term rapid sequence intubation is a misnomer because the procedure is certainly not rapid (Figure 20). Because of this, it can adversely affect patient outcome by prolonging scene time. Unless there is a critical need, the procedure should be performed during transport. In the urban setting where there are short transport times the need for a definitive airway should be balanced against use of other airway methods and the impact on transport times.
**Drug-Assisted Intubation**

**Indications for DAI:**
- Inability to maintain $SpO_2 > 90\%$ in unconscious patient with closed head injury and clenched teeth
- Severe flail chest with respiratory failure and inability to intubate due to gag reflex
- Other conditions as determined by medical direction

**ABCs**
- 100\% oxygen
- Assist ventilation
- Evaluate need for DAI
- Monitor $SpO_2$ and end-tidal CO$_2$

**Preparation:**
- IV access, assess airway for difficulty, assemble equipment
- Preoxygenate 3 min. with 100\% oxygen

**Bradycardia?**
- **YES**
  - Atropine 0.01 mg/kg IV
- **NO**
  - Etomidate 0.3 mg/kg IV or (Midazolam 0.1 mg/kg IV)
  - Apply cricoid pressure
  - If unable to intubate administer
  - Succinylcholine 1.0–1.5 mg/kg IV

**At the Attempt Intubation**
- Successful
  - Confirm tube position with assessment and $SpO_2$ plus ETCO$_2$
  - Continued paralysis: Vecuronium 0.1 mg/kg IV
  - Continued sedation: Midazolam 0.1 mg/kg IV
  - Monitor with pulse oximetry and capnography
  - Keep patient warm
  - Paralyzed patient can’t maintain temperature
- Unsuccessful
  - 1. Attempt placement of BIAD
  - 2. If unsuccessful perform surgical airway

**Consider pain control measures**
- (Morphine IV) if patient is experiencing pain

*FIGURE 20* Steps in drug-assisted intubation.
A variant of the practice of rapid sequence induction used by anesthesiologists when confronted with a nonfasting patient, the DAI technique allows the intubator to achieve conditions that improve the likelihood of intubating the patient, while minimizing the risks of aspiration, by rapidly administering a sedative and paralytic to improve intubating conditions. In some jurisdictions, a paralytic is not used, and benzodiazepines and opiates in combination are administered to achieve intubating conditions.

Numerous studies have shown that EMS personnel can be effectively taught to use DAI and apply it in the field setting. Other studies have shown a potential for prolonged hypoxia during this procedure, so constant recording of pulse oximetry reading should be done, and there should be a strict quality improvement program that monitors intubation time, oxygenation of the patient, and scene time.

The actual technique of DAI is quite simple. The difficult part for EMS personnel is to recognize the patient who should not undergo DAI. The worst thing you can do in airway management is take a spontaneously breathing patient and place her into a “can’t intubate and can’t ventilate” situation. All personnel who utilize DAI should be familiar with and able to use one of the many supraglottic blind insertion airway devices (BIADs) and also should be able to perform a cricothyroidotomy if unable to ventilate or intubate the patient.

Last (but most important of all), all EMS personnel should be able to manage an airway using a bag-mask. Remember BLS comes before ALS. Some EMS providers erroneously see use of DAI and even intubation as a measure of “prestige.” It is simply one of many tools available to us to manage an airway. The real trick is to choose the right one for your patient and correctly apply it.

Performance of DAI in the field remains controversial. Some studies have shown worse outcomes in patients (especially serious head injuries) who undergo DAI in the field, and this is attributed to longer scene times. Other studies question whether this delay is significant. Also there is the related issue of transport times. Short times to definitive trauma care may allow for less-invasive airway management, as long as the airway can be kept opened and adequate ventilation and oxygenation ensured.

Other concerns raised with this technique include skill retention on the part of field providers, something that is an issue for many of the advanced procedures performed by EMS.

The decision to implement the use of DAI by an EMS system should be carefully reviewed, especially with respect to issues of skill retention, transport times, and the availability of alternative airway methods. Any system using DAI must have in place a strong educational and quality improvement program.

**TECHNIQUE**

The ideal approach uses the six Ps: preparation, preoxygenation, premedicate, paralyze, pass the tube, confirm position. They are as follows:

1. **Preparation.** First, evaluate the difficulty you may experience when you try to intubate. Do this by using the Mallampati score. (See Chapter 4.) If the patient appears to be particularly difficult to intubate, you would be better served using a supraglottic BIAD or bag-mask than struggling with a paralyzed, apneic, hypoxic patient. If you decide to perform DAI, you should have a plan for an escape airway should intubation be unsuccessful. All necessary equipment, including suction, should be readily available and checked.
Proper positioning is an important part of preparation. Although the EMS environment often precludes placing the patient at a good height on a stretcher in the sniffing position, any steps you can take to better position yourself so that you have the best view are helpful. Given that many of your patients are in spinal motion restriction, one positioning step you can take, just prior to intubation, is to remove or loosen the cervical collar and apply in-line stabilization. This will allow you to move the jaw forward and improve visualization of the cords.

2. **Preoxygenation.** Because the patient will be rendered apneic, hypoxia will rapidly follow. To extend the time for intubation, nitrogen in the lungs is “washed out” by having the patient breathe 100% oxygen for 2 to 3 minutes. Washout of the nitrogen allows the patient to tolerate up to 5 minutes of apnea (only 2–3 minutes in children) during intubation without becoming hypoxic. In patients with airway compromise or other problems, ventilations can be assisted, though care should be made not to ventilate with too much force, thus reducing the risk of insufflating air into the stomach and thus regurgitation of stomach contents leading to aspiration. Application of cricoid pressure (Sellick’s maneuver) will help reduce this, as well as reduce risk of aspiration as the lower esophageal sphincter relaxes after administration of paralytic. All patients should be placed on a cardiac monitor, a pulse oximeter, and a capnometer at this time, if not previously done.

3. **Premedicate.** Both the act of intubation and some paralytics can raise intracranial pressure. Though advocated in the past, use of IV lidocaine prior to intubation has been found to be of no benefit in the field setting. Pediatric patients given succinylcholine may develop bradycardia. Most experts feel that pediatric patients and those adults receiving a repeat dose of succinylcholine should receive 0.1 mg/kg of atropine. Remember also in the pediatric patient that the use of a length-based system, such as the Broselow tape or similar, can decrease dosing errors. Depolarizing paralytic agents like succinylcholine can cause fasciculations, which can cause a rise in both intracranial pressure and intraocular pressure as well as be uncomfortable for the patient. A nondepolarizing blocking agent such as vecuronium at 0.01 mg/kg can be given at 3 minutes prior to administering the paralytic agent. Because it adds time to the process in what is often a time-critical situation, many field providers omit this step.

   The last premedication is the sedative. This ensures that the patient is not awake while paralyzed. Benzodiazepines such as versed at 0.1 mg/kg can be used, though etomidate (0.3 mg/kg) is a more common sedative agent and has the advantage of having minimal effects on hemodynamics. Some trauma surgeons do not support use of etomidate due to reported adrenal suppression, with even a single dose.

4. **Paralyze.** Two types of paralytics are available. A depolarizing agent, such as succinylcholine is the preferred agent due to rapid onset of action and rapid degradation. At a dose of 1 to 1.5 mg/kg (2 mg/kg in children), intubating conditions are achieved within 90 seconds of administration and is cleared within 5 minutes. Contraindications to use of depolarizing agents are listed in Table 2.

   Nondepolarizing agents have a longer onset, and paralysis lasts longer. The fastest acting agent is rocuronium (0.5 mg/kg adult; 0.75 mg/kg in
OPTIONAL SKILLS

Table 2  Contraindications for Use of Succinylcholine

<table>
<thead>
<tr>
<th>Absolute</th>
</tr>
</thead>
<tbody>
<tr>
<td>• History of Malignant Hyperthermia</td>
</tr>
<tr>
<td>• Burns over 24 hours old</td>
</tr>
<tr>
<td>• Crush injury over 48 hours old</td>
</tr>
<tr>
<td>• Stroke, cord injury &gt; 7 days &lt; 6 months</td>
</tr>
<tr>
<td>• Sepsis over 7 days</td>
</tr>
<tr>
<td>• Myopathies, denervating diseases</td>
</tr>
</tbody>
</table>

Table 3  Suggested Drug-Assisted Intubation Timeline

<table>
<thead>
<tr>
<th>Time</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Paralyze</td>
</tr>
<tr>
<td>0.75 to 1.5 minutes</td>
<td>Pass the tube</td>
</tr>
<tr>
<td>1.5 to 2 minutes</td>
<td>Confirm position</td>
</tr>
<tr>
<td>2 minutes</td>
<td>Postintubation care</td>
</tr>
</tbody>
</table>

children). Vecuronium 0.1 mg/kg can be used to maintain paralysis after intubation is successful.

5. *Pass the tube.* Once intubating conditions are achieved, pass the tube. Aids in the process include the use of a stylet, the gum elastic bougie, and external laryngeal manipulation.

6. *Confirm position.* Use techniques described in Chapter 5. Use of capnography is mandatory so that inadvertent tube dislodgement can be detected. See ideal timeline for DAI in Table 3.

OPTIONAL SKILL 8: Short Backboard

Objectives

• Perform SMR with a short backboard.

TECHNIQUE

Remember that the priorities of evaluation and management are done before an SMR device is applied. To apply a short backboard, follow the steps listed in SCAN 1.
Stabilize neck and perform ITLS Primary Survey.

Apply a semirigid extrication collar.

Position the short backboard behind the patient. Coordinate all movement so that movement of the spine is kept to a minimum.

Apply straps and tighten securely.


