Advanced Airway Techniques
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KEY POINTS
- Advanced airway management is predicated on selecting the right technical approach for a given patient.
- Anticipated difficult airway management often relies on a sedated (or “awake”) technique.
- An organized approach (and backup plan) is essential for success with an unanticipated difficult airway.

PERSPECTIVE

The cognitive skills to determine when a patient requires airway support are as important as the manual skills to accomplish the task. Currently, rapid-sequence intubation (RSI) is the most frequently used and successful means of intubating the trachea in emergency medical practice. It is clear that combining the use of a paralytic agent with a sedative agent has resulted in more successful laryngoscopy. This has led to fewer failed airways. Because every attempt at intubation may be difficult, a prepared and practiced backup or contingency plan is vital. The discussion of the various techniques and adjunctive measures that follows in this chapter reflects their application within an overall strategy.

In some cases the use of paralytics (i.e., RSI) is inappropriate because of a relatively high likelihood of intubation failure and subsequent worsening of the clinical condition linked to intubation attempts and the probability of failed ventilation. Accordingly, it is important to distinguish patients who are likely to be difficult to intubate, ventilate, and rescue (which often means performing a cricothyrotomy). These concepts are emphasized by the LEMON, MOANS, and SHORT mnemonics covered in Chapter 1. What follows is an overview of a strategic approach to advanced emergency airway management.

EPIDEMIOLOGY

A difficult airway (a case in which intubation is difficult to achieve) in the emergency department (ED) is far less studied but is probably experienced more frequently than in the more controlled environment of the operating suite. Patient extremis and lack of patient preparation make encountering both anticipated and unanticipated difficult airways more likely, with some estimates as high as 20%. Fortunately, however, the frequency of intubation failure in the ED is much lower and approximates 1%. The prevalence of airways requiring rescue from previous failed attempts in the ED is difficult to determine. What is apparent is that rescue devices are not used routinely, although they are commonly available.

ANTICIPATED DIFFICULTY

Multiple predictors related to airway anatomy have been reported in the anesthesia literature, but none have been shown to be useful in isolation for predicting intubation difficulty. However, some evidence suggests the use of a limited set of assessments in patients undergoing airway management in the ED. The LEMON mnemonic has been proposed for this purpose (see Chapter 1). If difficulty is predictable and the patient is not a suitable candidate for RSI, the optimal approach depends on the previous training of the intubator and the availability of advanced airway tools.

UNANTICIPATED DIFFICULTY

Every patient in any environment has the potential for unexpectedly being difficult to intubate. Unexpectedly encountering blood, emesis, a mass, an anatomic variant, or evolving traumatic injury can all result in a challenging airway. In this chapter we attempt to organize and briefly define some of the many rescue techniques that might be used in emergency practice.

ANTICIPATED DIFFICULT AIRWAY

Only a small fraction of patients undergoing ED intubation are actually deemed poor candidates for RSI, even though many patients are expected to be difficult to intubate. No discreet threshold at which RSI is deemed to be safe and when it is contraindicated has ever been determined, partly because of the lack of sensitivity of the various difficult airway prediction tools. Importantly, many ED patients are in extremis and unable to cooperate with a preprocedural examination. Much of what is discussed in the current literature is based on the anesthesia experience, which generally reflects the “elective” intubation of cooperative patients. Nevertheless, it is often useful to perform a preprocedural assessment, as allowed by time constraints and the patient’s condition. Some
evaluation is necessary to be able to accurately estimate the potential for encountering a difficult airway.

The algorithm presented in Figure 2.1 represents a clinical approach to a difficult airway. Application of such an approach is predicated on the answers to several key questions:

- Is there enough time to plan a methodic approach?
- Despite the identified presence of difficult airway predictors, can RSI still be used safely?
- Is the patient’s oxygenation adequate?

Understanding these issues in context to a given clinical scenario will help in the decision-making process regarding alternative approaches.

**RAPID-SEQUENCE INTUBATION FOR A DIFFICULT AIRWAY**

RSI is preferred for the vast majority of intubations performed in the ED. It is important to realize that provider familiarity will probably be the major determinant regarding device and technique selection beyond the use of RSI. For this reason it is prudent to focus on techniques that are likely to remain familiar through frequent use. Accordingly, the use of optimized and augmented laryngoscopy merits discussion because these concepts are simply extensions of “routine” RSI.

**OPTIMIZED LARYNGOSCOPY**

Routine direct laryngoscopy relies on manipulation of the soft tissues of the hypopharynx and the base of the tongue into the relatively fixed proportions of the mandible. The goal of such manipulation is to allow a direct line of sight to the larynx and vocal cords. This, however, can be difficult given certain unalterable variables of patient anatomy. The process of optimizing the view is probably the simplest and often the least appreciated of the skills of an expert airway manager. The features of optimization are discussed in the following sections.

**Head and Neck Positioning**

In the absence of cervical spine immobilization, active range of neck flexion and extension can frequently provide markedly improved visualization.

**External Laryngeal Manipulation**

External manipulation of the larynx is distinct from the familiar cricoid pressure concept (e.g., the Sellick maneuver). It is, however, related to BURP (backward, upward, rightward pressure). The process of laryngeal manipulation is active. It requires that the intubator actively move the larynx to maximize visualization of the laryngeal structures. Generally, once the view is optimized, an assistant will be required to maintain the preferred positioning.

**Facility with Various Blade Types**

Laryngoscope blade types come in various sizes and shapes and therefore have various advantages and disadvantages. In general, two formats are used with regularity: curved (e.g., Macintosh) and straight (e.g., Miller). Curved blades are often best for sweeping the tongue laterally. Some patients may be difficult to intubate because of an elongated or anteriorly oriented vallecula and epiglottis. In such cases, a straight blade may prove to be useful. Although most practitioners will have a preferred blade, it is important to maintain facility with both general blade types because they often have offsetting advantages. Additionally, a multitude of variably profiled laryngoscopes with adjunctive prisms and mirrors are available. These devices are not frequently used in emergency practice.

**AUGMENTED LARYNGOSCOPY**

This concept refers to using an assistive device to either extend the view of the intubator (i.e., fiberoptic stylet) or assist in tube placement with use of a narrow-diameter introducer. Such introducers have been used for decades and come in various formats (i.e., Eschmann, Frova). The leading tip of these introducers is angled anteriorly to provide tactile feedback regarding location of the introducer. These devices can be valuable when visualization is limited.
ALTERNATIVE TECHNIQUES FOR THE ANTICIPATED DIFFICULT AIRWAY

**Fiberoptics**

As a class, directable and flexible scopes have been available for decades. They have recently been made more portable by replacing the heavy light source with a battery pack. These devices are consequently more convenient in the harried ED. The majority of the products currently on the market consist of a directable cable mechanism associated with a light source and fiberoptic bundle. Notable issues are that the glass fibers that constitute the optics are breakable and small amounts of debris can greatly diminish viewing quality. Historically, these devices were considered too expensive or impractical. In the future, however, these type of flexible and directable devices will probably become more available. To date, relatively little research relevant to emergency medicine practice has been conducted.\(^2^,\(^2^7^-^2^9\) A recent query of emergency medicine training programs in the United States suggests that the majority maintain this type of equipment,\(^1^1\) but clinical expertise is variable.

**FLEXIBLE AND DIRECTABLE FIBEROPTICS** Flexible and directable fiberoptic models are portable and have variable diameters and lengths. This equipment varies depending on its intended purpose. The shorter nasopharyngoscope is approximately 35 cm in length, in contrast to the 60-cm bronchoscope. The goal is to directly visualize the glottis via the nares or mouth. Once the cords are visualized, the tip of the fiberoptic scope is advanced into the airway to the level of the carina. The preloaded endotracheal tube is then advanced over the scope and into the airway. Efficacy of this technique in an awake patient requires adequate patient and equipment preparation (Box 2.2).

**FLEXIBLE AND NONDIRECTABLE FIBEROPTICS** Flexible and nondirectable fiberoptics have been designed to be used from within the lumen of an endotracheal tube. They all share in common the issues related to obscuration of view with debris. Additionally, any attempt to direct the tip of the device relies on manipulation of the associated endotracheal tube with visual feedback through either an eyepiece or video monitor. Despite these shortcomings, these devices are attractive because the nondirectable group is generally regarded as more durable and tends to be less expensive. An example of this type of device is the Trach View (Parker Medical, Englewood, CO).

**SEMRIGID FIBEROPTICS** The semirigid fiberoptic scope is, conceptually, a semimalleable stylet with internal fiberoptic bundles.\(^3^4\) These devices are similar to the nondirectable class

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**TIPS AND TRICKS**

Even though a complete tutorial of the technical details of using flexible fiberoptics is beyond the scope of this review, several technique pearls are worth highlighting:

1. Recognize that the procedure will take at least 15 to 20 minutes to accomplish. If the patient cannot tolerate such a wait, use of this technique may be misguided.
2. Stay in the anatomic midline at all times during the procedure. Straying laterally will often result in poor visualization and inability to pass the vocal cords.
3. Keep the slack out of the scope. If slack is present along the length of the scope, rotation of the body of the scope will not translate into rotation of the tip.
4. The size of the working channel in many scopes is often too small for suction to be effective.
5. If the tube is resistant to passage of the scope into the airway, it is likely that the tip of the tube, or Murphy’s eye, is caught at the level of the arytenoids. Rotation of the entire tube-scope apparatus 45 to 90 degrees will probably overcome the obstruction.
6. Further considerations:
   - Nasal approach. This route may be better tolerated by the patient and will not subject the equipment to damage from biting by the patient. However, it is prone to cause bleeding with passage of the tube. Adequate vasoconstriction is key. Partially intubating the chosen nares with the endotracheal tube can often simplify the procedure by avoiding the obscuring materials in the nasopharynx. Beware, however, that placing the tip of the tube too deep into the posterior pharynx will make subsequent scope manipulation challenging because of the acute angle that will be required for the tip of the scope to reach the glottis. Optimally, the tip of the endotracheal tube should be placed at the level of the uvula before attempting to advance the scope to the vocal cords.
   - Oral approach. This may be advantageous if a larger endotracheal tube is needed. However, a bite block or a device that provides an oropharyngeal conduit may be necessary if there is a possibility of the patient biting the equipment. Additionally, a fiberoptic technique can be used in conjunction with a second provider using a laryngoscope to manipulate the soft tissues of the oropharynx.
   - Adjunctive use. Use of flexible fiberoptics through a laryngeal mask airway or similar device has been described.\(^3^5^-^3^3\)

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**BOX 2.2 Patient Preparation**

If using a nasal approach, adequate topical anesthesia and vasoconstriction can be achieved with various agents via an atomizer.

If using an oral approach, various spray anesthetic agents can be used in addition to a nebulized agents (e.g., lidocaine). Additionally, gargled lidocaine (4%) can be effective, patient cooperation permitting.

An antisympathetic (e.g., glycopyrrolate) can be useful to allow better tissue absorption of topical anesthetic agents. However, at least 20 minutes is needed for efficacy as a drying agent.

Sedation is used, as necessary, to achieve reasonable anxiolysis to improve patient cooperation.

Preoxygenation, as always, is fundamental to procedural sedation and airway management.

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of fiberoptics with respect to image quality and durability. An example of this type of device is the Shikani optical stylet (Clarus Medical, LLC, Minneapolis, MN).

**Rigid Fiberoptics**

Rigid fiberoptic scopes consist of an imaging bundle enclosed within a rigid L- or J-shaped assembly. This shape is designed for placement into the hypopharynx with subsequent indirect visualization of the glottis. One of the chief advantages of these devices is that limited head, neck, and jaw mobility is less of a concern because of the ability to “look around the corner” of the hypopharynx. Examples in this class are the Bullard (Circon Corporation, Stanford, CT),15,27 WuScope Tubular Fiberoptic Laryngoscope (Achi Corporation, San Jose, CA),38,41 and UpsherScope (Mercury Medical, Inc., Clearwater, FL).42,43 These scopes are relatively expensive and their availability in the ED has been limited.11

**Optical Laryngoscopy**

Optical laryngoscopes use a series of lenses to provide a view of the anterior aspect of the glottis that is often not possible with direct laryngoscopy. Although image quality is inferior to that of video laryngoscopes, optical laryngoscopes are inexpensive, durable, and portable tools for difficult airway management. An example is the Airtraq, a disposable optical laryngoscope with a J-shaped blade that allows visualization of the glottis with the head and neck in a neutral position. In small randomized and nonrandomized studies, the Airtraq improved glottic exposure, reduced intubation difficulty scores, decreased cervical spine motion, and caused less change in the heart rate than did direct laryngoscopy with a Macintosh laryngoscope.44-46

**Video Laryngoscopy**

Video laryngoscopes use either a micro video camera or more traditional fiberoptic bundles encased in a laryngoscope handle design. Placement of the camera is meant to provide a wide-angle view of the glottis but is somewhat more removed from the various debris issues often encountered with the optics-in-the-tube format. The GlideScope (Verathon, Inc., Bothell, WA) is an example of the micro video camera design. This device is relatively new with limited ED experience.47 The literature that exists suggests that it can be used with very little motion of the cervical spine and that glottic visualization is generally excellent.48-51 However, actual intubation may be a bit more of a challenge because it requires an extreme “hockey stick” angulation of the styletted endotracheal tube to reach the glottis. Currently, laryngoscope sizes available correspond roughly to Macintosh No. 4 and No. 2, as well as pediatric sizes.

Additionally, video has been adapted to the more familiar Macintosh blade format in the current C-MAC (Karl Storz, Tuttlingen, Germany). The video element has been shown to improve the grade of view in ED patients52 and in simulated patients with difficult airways.53

**Awake Techniques**

In the context of a difficult airway the role of an awake technique may be (1) to determine the status of airway landmarks (with the intention of performing RSI if the landmarks are recognizable) or (2) to perform the intubation given the need for the patient to maintain spontaneous respirations. Either may be accomplished with direct laryngoscopy. A confirmatory look may also be done with a flexible fiberoptic scope.

The term “awake” is a misnomer. It is important to realize that a better descriptor of this concept would be “sedated.” In a patient who is currently maintaining some airway tone and respiratory drive, this approach may be indicated when difficult intubation and ventilation are both anticipated. This approach may be somewhat time consuming because adequate sedation and topical anesthesia of the airway are required (Box 2.3). However, its advantage is that patients will be able to breathe on their own during attempts at definitively controlling the airway. It is important to understand the underlying pathologic process with respect to its dynamic impact on the airway. For instance, a quick look to determine the risks associated with RSI may be misleading if rapid swelling from burns or angioedema are evolving during the process. This

**TIPS AND TRICKS**

**GlideScope Use**

The GlideScope handle stays in the midline—no tongue sweep.
The handle is not used to lift, unlike a more familiar laryngoscope.

To accommodate the approach to the glottis, the endotracheal tube with stylet will need an acute angle (approximately 90 degrees).

To accommodate advancement of the tube off the stylet, it may help to partially withdraw the stylet during tube advancement. Generally, this last step will require coordination with an assistant.

**BOX 2.3 Patient Sedation and Topical Anesthesia: A Recipe**

**Nasal (Anesthesia and Vasoconstriction)**

Only needed if the nasal route is anticipated
Oxymetazoline (0.05%)/lidocaine (1%), 1:1 in a mucosal atomizer, 10 mL total
Use preservative-free (cardiac) lidocaine to avoid the rare allergic reaction to preservatives
Provides effective anesthesia and vasoconstriction
Time: 2 to 3 minutes

**Oral**

Lidocaine (4%), 30 mL gargle and spit
Time: 1 to 2 minutes

**Glottis**

Lidocaine (1% to 4%, preservative free), 10 mL in a nebulizer
Time: 10 minutes

**Sedation**

The goal is only light sedation
Deep procedural sedation defeats the purpose and may lead to airway obstruction
The concept should be kept in mind as much as an initial look may be reassuring but subsequent attempts may be profoundly disappointing because of a dynamic clinical process.

**Blind Nasotracheal Intubation**

The overall success rate of blind nasotracheal intubation is lower than that of RSI. Additionally, such intubation can be complicated by nasal hemorrhage and induction of vomiting (with its associated risk of aspiration). However, it is often an expedient option in patients who still have fairly vigorous spontaneous respirations.

**Light Wand**

In general, light wand intubation does not rely on visualization of any internal structure. Instead, it relies on a transmitted glow of light through the soft tissues of the neck. The skill required for its application depends largely on recognizing midline (i.e., tracheal) versus lateral soft tissue placement. The Trachlight has been shown to be useful in the operating suite, but ED experience has been limited. Its design and the necessity for a pronounced L-shaped curve in the stylet and endotracheal tube make it rather forgiving of difficult anatomy that might otherwise inhibit direct laryngoscopy. It is important to note that proper tube placement and preparation of the device do take a few minutes. To make it more useful as a rescue device and more amenable to quick grab deployment, it should be prepared and stored in a ready-to-use condition.

**THE UNANTICIPATED DIFFICULT AIRWAY**

The concept of an unanticipated difficult airway generally presupposes that an attempt at intubation has already been made. It is often a situation that necessitates a change from the original strategy used and requires a fresh perspective. Even though failed intubation attempts are infrequent, they do occur and a rational backup or rescue plan must be in place. Ultimately, the choice of rescue devices is limited by simple availability or experience with use. We will attempt to highlight the various classes of devices that appear promising for use in emergency practice.

The difficult airway and failed airway are related but distinct concepts. A difficult airway becomes a failed airway after three attempts at intubation by a skilled operator. From this point, subsequent maneuvers are in large part directed by operator familiarity and skill. However, the key branch point in the decision-making process depends on the adequacy of ventilation. The “can’t intubate, can ventilate” scenario is managed differently from the “can’t intubate, can’t ventilate” scenario. Each of these situations will be approached within the concept of the failed airway algorithm (Fig. 2.2).

**CAN’T INTUBATE, CAN VENTILATE**

Successful ventilation is defined as being able to maintain oxygen saturation above 90% with bag-mask ventilation. In this situation the provider has some time to direct further efforts and take advantage of any opportunity for success as identified on previous attempts. A directed response might include optimizing or augmenting a previously failed RSI with maneuvers discussed previously. Additionally, it may include the use of alternative intubation devices.

**Tracheal Introducer**

The tracheal introducer has been in use since the 1940s, and several products are currently available on the market. The Eschmann introducer is also known as the gum elastic bougie. Incidentally, this term is a misnomer because it is not a bougie (e.g., dilator), nor is it made from gum. Instead, it is a woven Dacron rod 30 cm long that is coated with resin for durability and added stiffness. Newer products have also recently arrived on the market (e.g., Frova, Cook Medical, Bloomington, IN). These introducers are used in conjunction with direct laryngoscopy, especially when the vocal cords cannot be visualized. Their design helps access an extremely anterior trachea and confirm proper placement. One of these design features is an angulated tip that allows directable manipulation and tactile feedback. The tip clicks as it bumps along the anterior tracheal rings. The absence of clicks may suggest esophageal placement. Additionally, if the introducer is in the airway, a hard stop will be felt as the introducer gently passes from the trachea into a small-diameter airway. In contrast, if the introducer is mistakenly placed in the esophagus, the operator will be able to advance the introducer without a firm end point as the introducer enters the stomach. Once these tactile indicators suggest tracheal placement, a standard endotracheal tube can then be advanced over the introducer and into the trachea.

**The Laryngeal Mask Airway**

The laryngeal mask airway (LMA) currently has several variations in format, one of which, the intubating LMA (ILMA, e.g., Fastrach), is shown in Figure 2.3. This device has been
Fig. 2.3 Intubating laryngeal mask airway (ILMA) (Fastrach). A, The ILMA. B, Place in the oropharynx. C, Position and inflate the ILMA cuff. D, Ventilate the patient with the ILMA. E, Place the ETT into the ILMA. F, Ventilate the patient with the ETT. G, Remove the adaptor. H, Use the stabilizer to remove the ILMA. I, Allow the balloon to pass through. J, Confirm tube placement and ventilate. ETT, Endotracheal tube.
Box 2.4

Success with a Tracheal Introducer
Ideal use is when the vocal cords are too anterior to visualize them well with direct laryngoscopy. Have a helper ready to assist in advancing the tube over the introducer. Once the introducer is in trachea, keep the laryngoscope in place and continue lifting. This will straighten the path for the endotracheal tube to slide over the introducer into the trachea.

If resistance is met as the endotracheal tube is advanced to the level of the glottis, the tube should be withdrawn slightly, rotated 45 to 90 degrees, and then advanced with gentle pressure.

TIPS AND TRICKS

Can’t Intubate, Can’t Ventilate
In this dire situation the vast majority of patients will require an invasive airway unless the expeditious use of an extraglottic rescue device can convert the situation to “can’t intubate, can ventilate.”

Rescue Airway Devices
Rescue devices establish an airway for oxygenation and ventilation and sit in an extraglottic position instead of passing through the vocal cords. They are critical tools for the management of difficult and failed airways. The most commonly used extraglottic devices are laryngeal masks (LMA [La Jolla, CA], intubating laryngeal airway [ILA]) and laryngeal tubes (King LT, King Systems, Noblesville, IN; Combitube, Nellcor, Boulder, CO). In emergency airway management, an extraglottic device can be used to provide ventilation until a definitive airway is established, thereby converting a “can’t intubate, can’t ventilate” situation to a “can’t intubate, can ventilate” one. Placement of the extraglottic device and verification of successful ventilation must be done rapidly because failure of the device and worsening hypoxemia would necessitate emergency cricothyrotomy.

The LMA and ILA are two devices designed to create a mask seal over the laryngeal inlet to ventilate and oxygenate patients for short to intermediate periods during elective anesthesia or emergency airway management. The mask portions of each of these devices are similar in shape, but the ILA mask is slightly stiffer to prevent folding of the leading edge during insertion. Many clinicians have familiarity with laryngeal masks, thus making them useful rescue devices. Anesthesia studies report that the ILMA is effective in managing difficult and failed airways, but its performance in ED airway management has not been adequately studied.66-72,74,75 Several models are commercially available, but only two allow placement of a cuffed endotracheal tube in the trachea through the device (ILMA and ILA) and may therefore be more appropriate as rescue devices in the ED.

An additional type of extraglottic device is a laryngeal tube such as the Combitube and the King LT. These devices have a pharyngeal cuff and an esophageal cuff with a port between the cuffs at the level of the laryngeal inlet for ventilation. The King LT is shorter and simpler than the Combitube, has one large lumen instead of two smaller ones, and uses only one inflation valve to fill both cuffs. Few studies comparing extraglottic rescue airway devices have been performed, and data regarding superiority of one over another as rescue devices are lacking.76,77

Invasive Intubation
Studies done since the common acceptance of RSI in the ED show that approximately 1% of patients at large trauma centers still require cricothyrotomy.13,10 Several procedures have generally been performed via an open surgical technique. However, newer developments have provided a percutaneous option. The advantage of this technique may lie in its familiarity of use because it relies on the routinely used Seldinger technique.

Several key considerations need to be taken into account with respect to cricothyrotomy. First, it should be recognized that providers are often hesitant to perform what may be perceived as a highly problematic and complicated procedure. In current practice it is not uncommon for the person performing the intubation to be the same individual who needs to recognize failure. Additionally, it is this same provider who will need to change course and provide an invasive airway. In this circumstance, overcoming cognitive inertia can be difficult and contribute to a disastrous delay. Many practitioners say that the most difficult portion of performing a cricothyrotomy is simply making the decision to do so. Such a decision is mandated in a “can’t intubate, can’t ventilate” scenario unless a bridging device can be used successfully. The presence of certain features may influence the actual approach chosen. It should be kept in mind that certain clinical circumstances may make an invasive airway particularly challenging. The mnemonic SHORT (Box 2.4) has been proposed for use when considering an invasive airway. Several technical variants of cricothyrotomy are in common use.

Open Surgical Technique
Among the techniques described in the literature, two are commonly referenced. Standard Technique The standard technique generally involves the surgeon being positioned over the right shoulder of the patient. The incision is midline and vertical, and a tracheal hook is placed into the thyroid cartilage. Cephalad traction is applied and a horizontal incision of the cricothyroid membrane is created. Dilation of the incision is followed by intubation (Fig. 2.4).78,79
**Box 2.4 Difficult Cricothyrotomy**

**Mnemonic: SHORT**

- Surgery (i.e., neck scar)
- Hematoma
- Obesity
- Radiation therapy involving the neck with a subsequent scar
- Trauma with disrupted landmarks

**Rapid Four-Step Technique**

This technique has evolved from the standard technique for sake of expediency. The procedure is initiated from the head of the gurney, where the intubator is most likely to be positioned. If the pertinent anatomy is clearly palpable (step 1), the skin and cricothyroid membrane are incised simultaneously with a No. 20 scalpel in a horizontal orientation (step 2). A blunt hook is then applied along the caudal side of the scalpel. The hook is used to apply traction to the cricoid ring (step 3). The incision is thus stabilized and widened for subsequent intubation.
PEDIATRIC CONSIDERATIONS

Most of the adjunctive devices discussed in this chapter have limited or no application to young children. There is probably overlap among older children and teens as size allows; however, very little research in this area has been performed. What follows is a brief summary of products that have some applicability to infants and children.

RESCUE DEVICES

Classic Laryngeal Mask Airway

No intubating form of the LMA is available for pediatric patients. Although the small adult size might accommodate a larger teen, these devices are scaled to fit on the basis of height considerations. The classic (nonintubating) LMA is available in all sizes appropriate for teens to neonates.

King LT

This device is available in sizes appropriate for children, as well as infants.
Fig. 2.6 Percutaneous cricothyrotomy with the Cook (Melker) kit. A, Kit contents. B, Cuffed tube. C, Place the needle through the cricothyroid membrane. D, Place the wire through the needle. E, Incise the skin. F, Thread the dilator/tube over the wire. G, Advance the tube into the airway. H, Remove the dilator and wire.
SECTION I  RESUSCITATION SKILLS AND TECHNIQUES

GlideScope for Children
Currently, a small GlideScope is available for children as small as 2 kg.

Fiberoptics
Flexible fiberoptic scopes have been developed for very small airways. However, the diameter of these scopes is generally too small to allow easy passage of the endotracheal tube off the scope into the airway. This “railroading” method in thinner scopes is more likely to kink the scope. This risks breaking the scopes and is prone to failure.

INVASIVE CONSIDERATIONS
In children younger than 10 years, open cricothyrotomy is contraindicated because of airway size. Currently, the only invasive method that is available for use in young children and infants is needle cricothyrotomy, which is commonly discussed in the context of jet insufflation. Such high-pressure oxygen has been shown to provide adequate short-term oxygenation with somewhat less successful ventilation. This technique does nothing to protect the airway because a cuffed tube is not present in the airway. Various adapted combinations have been described to allow the use of a ventilation bag (plus adaptor) with a cricothyrotomy needle. The pressure generated with such a bag is generally inadequate for all except small infants. In general, jet ventilation catheters such as the VBM catheter (Medizintechnik GmbH, Sulz am Neckar, Germany) are used with high-pressure jet ventilation systems (Fig. 2.7). Barotrauma is often a concern, and kinking or egress of the catheter from its original placement as a result of the high pressure can be an issue. In such a case, manual stabilization of the catheter assembly is prudent until a definitive airway can be established.

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References can be found on Expert Consult @ www.expertconsult.com.
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