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FEATURE ARTICLES

The difficult airway: Implications for the otolaryngologist–head and neck surgeon

Bradley J. Goldstein, MD, PhD,[a] David Goldenberg, MD[b]

From [a]Maine Coast Otolaryngology–Head and Neck Surgery, Maine Coast Memorial Hospital, Ellsworth, Maine; and the [b]Department of Surgery, Division of Otolaryngology–Head and Neck Surgery, Penn State College of Medicine, Penn State Milton S. Hershey Medical Center, Hershey, Pennsylvania.

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Clinical situations arise in which maintenance of adequate ventilation becomes technically difficult, often either in an emergency setting or perioperatively. The otolaryngologist–head and neck surgeon is frequently called upon to provide expertise in airway management. The present article discusses approaches to the patient with a difficult airway. Problems are divided into either acute or elective situations. Algorithmic approaches and specific techniques are reviewed.

A clinical situation involving the patient with a difficult airway can be broadly categorized into (1) an acute or urgent problem or (2) an elective situation with a known or suspected anatomical difficulty. Obviously, the 2 scenarios are handled differently. A logical algorithmic approach can prevent a poor outcome in these often-stressful situations. Securing the airway is the top priority in any critical or resuscitation algorithm. Thus, ensuring an adequate airway is a basic skill all physicians should possess. The otolaryngologist–head and neck surgeon (OHNS) has expertise in laryngoscopy, bronchoscopy, and surgical approaches to the airway and is, therefore, uniquely qualified to lead a team approach with the anesthesiologist in managing difficult airway problems.

The present discussion will review causes underlying difficult airway situations and approaches to emergency versus elective airway problems. Management algorithms will be reviewed. Specific techniques commonly used by the OHNS to secure the difficult airway will be described, including (1) direct laryngoscopy with intubation using an Eschmann stylet, (2) "awake" fiberoptic nasotracheal intubation, (3) awake tracheotomy, and (4) emergency cricothyroidotomy. Other devices are discussed briefly. Although percutaneous tracheotomy has gained popularity, it is important to note that it is never appropriate as an emergency technique or in the establishment of a difficult airway and is mentioned in this context only to be condemned. Percutaneous tracheotomy is to be performed only on previously intubated patients, as discussed elsewhere in this issue of the journal.

Underlying causes for a difficult airway

As in most areas of medicine, a thorough history and physical can direct clinical care appropriately. The anesthesia and surgical team can prevent an airway emergency by being alerted, before induction, of predisposing factors for difficult intubation. In short, paralyzing a patient with a difficult airway may lead to an inability to ventilate him or her via mask, an inability to easily perform laryngoscopy, and an inability to easily place an endotracheal tube to secure the airway. Table 1 lists factors that may underlie a difficult airway. When recognized, a team approach to the airway following established algorithms should be instituted. As the person with training and experience in surgical and nonsurgical airway establishment, the OHNS should lead this team. Establishing clearly a team leader is critically important. Indecision, disagreements regarding the course of action, panic, or inappropriate interventions can be disastrous.[1]

An accepted grading system, the Mallampati classification, is used widely by anesthesiologists and can provide an

Address reprint requests and correspondence: Bradley J. Goldstein, MD, PhD, Maine Coast Otolaryngology–Head and Neck Surgery, 50 Union Street, Suite 1100, Ellsworth, ME 04645.
E-mail address: bgoldstein@mainehospital.org.

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Table 1 Difficult airway: Predisposing factors

Trauma
Midface
Mandible
Neck (penetrating or blunt)
Bleeding in the airway
Caustic ingestion
Thermal burns
Disease
Obstructive sleep apnea
Malignancy, mucosal (oral, pharyngeal, laryngotracheal)
Malignancy, extrinsic (thyroid, lymphoma, esophageal)
Foreign body
Degenerative cervical spine disease
Infection (deep neck space abscess, Ludwig's angina)
Trismus
Anaphylaxis
Angioedema
Previous head and neck surgery
Vocal cord paralysis
Anatomic/congenital factors
Retrognathia
Thick/short neck
Macroglossia
Small mouth opening
Kyphosis

estimate of the ease with which a patient's glottis can be visualized via direct laryngoscopy with a Macintosh or Miller anesthesia blade (Figure 1). However, grading systems are not 100% sensitive, and there is an estimated 2% to 3% incidence of unanticipated difficult airway events in patients undergoing general anesthesia.

Management algorithms

Elective surgical procedure: anticipated difficult airway

For an elective surgical procedure planned for a patient with a previously identified or suspected difficult airway, there are established algorithms that can be followed. Figure 2 outlines an algorithm accepted by the American Society of Anesthesiologists.[2] A critical feature of any airway difficult algorithm is to have alternative ("backup") strategies planned and readily available. For example, awake fiberoptic nasotracheal intubation may be planned, but the OHNS should have (1) a Holinger laryngoscope assembled, tested, and ready-to-use along with an Eschmann stylet and suction (Figure 3) and (2) a tracheotomy tray open and ready. In general, an awake or spontaneously ventilating patient may present with a safer airway situation than a patient undergoing induction of general anesthesia. The nonemergency pathway can be followed as long as a patient is either spontaneously breathing adequately or able to be mask ventilated well.

Impending or complete airway obstruction

For a patient with impending or complete obstruction, rapid establishment of the airway is required. The operating room is the safest place for airway control, although this is not always feasible. If the situation requires establishment of an emergency surgical airway, a cricothyroidotomy is generally the preferred procedure.[3] It is simpler and faster than a tracheotomy and has a lower complication rate. Cricothyroidotomy is indicated in the setting of inability to mask ventilate, intubate, or control the airway by other techniques, such as laryngeal mask airway or jet ventilation. Contraindications to cricothyroidotomy include subglottic stenosis or mass, or laryngeal trauma with inability to identify landmarks. In general, the procedure is avoided in small children. The procedure is performed by palpation of the cricoid in the midline with neck extension. The thyroid cartilage superiorly is stabilized with the nondominant hand, and skin, subcutaneous tissue, and the cricothyroid membrane are incised with a scalpel (Figure 4). A small tracheotomy tube or endotracheal tube is passed caudally into the trachea, and the patient is ventilated. The technique is discussed in detail elsewhere in this volume.

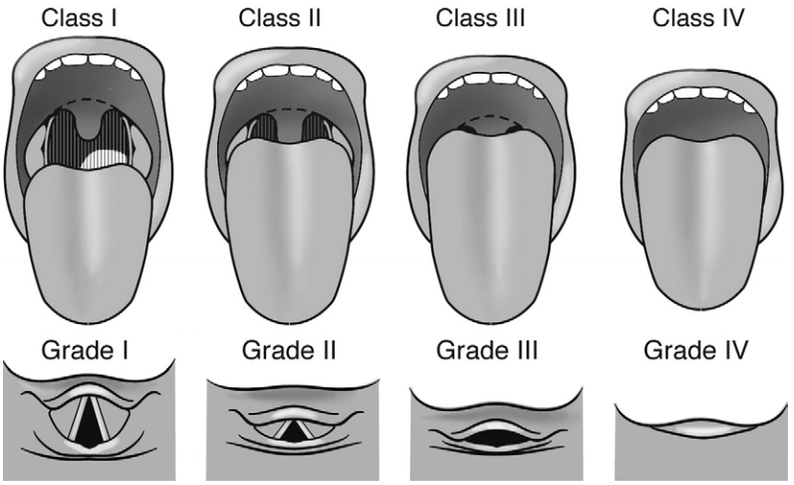

Figure 1 The Mallampati classification of oral opening. Class I: good view of soft palate, uvula, fauces, pillars; Class II: soft palate, uvula, fauces visible; Class III: soft palate visible; Class IV: only hard palate visible.

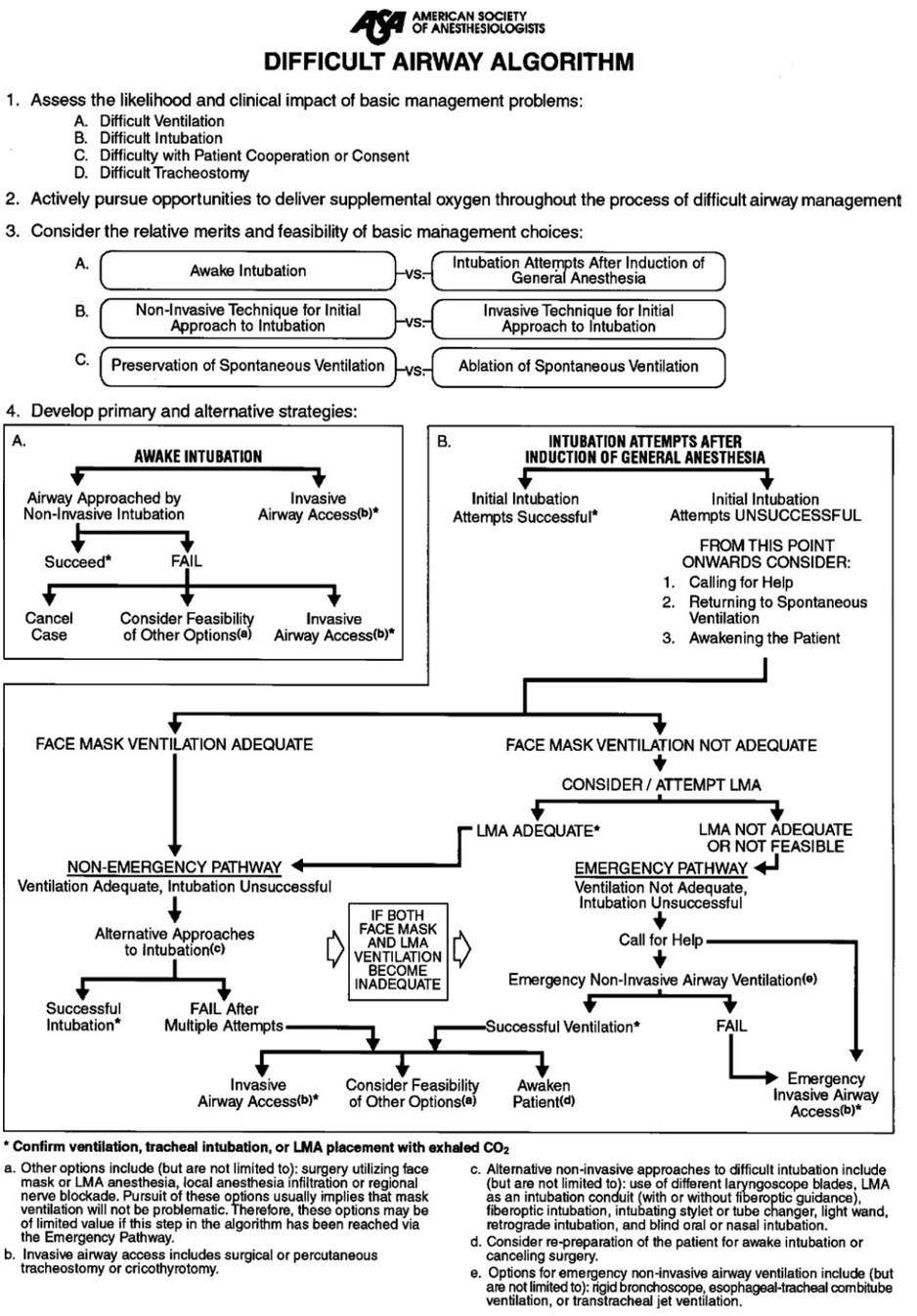

Figure 2 American Society of Anesthesiologists difficult airway algorithm.[2]

Compromised-but-stable airway

A different clinical situation involves the patient with a compromised-but-stable airway. Examples may include angioedema or an adult with supraglottitis. The patient is maintaining oxygen saturation and does not require an emergency intubation or surgical airway. However, the underlying disease process and the stability of the situation requires clinical judgment to determine the urgency with which the airway must be secured. In some cases, medical management in a closely monitored setting may be all that is required. The goals of treatment are (1) determination of the site(s) and degree of obstruction; (2) control the airway by forced ventilation, intubation, or surgical bypass of the site of obstruction; and (3) treatment of the underlying cause.[4]

Awake tracheotomy

As discussed previously, in an unstable, poorly ventilating patient, the airway must be secured. If intubation is deemed to be impractical (ie, fiber optic laryngoscopy indicates that an endotracheal tube will not pass through a narrowed airway), awake tracheotomy is performed. This is best performed in a controlled environment (eg, the intensive care unit or operating room) with local anesthesia on a patient who is awake.

It is crucial that there be clear communication between the OHNS, anesthesiologist, nurses, and technicians before the patient even enters the room; life-threatening emergencies may arise that necessitate close collaboration. Instruments and trays containing the most essential equipment should be ready.[5] For

Figure 3 Holinger laryngoscope, an Eschmann stylet, and an endotracheal tube.

an awake tracheotomy, the patient should be placed in a semi-Fowler position to give the anesthesiologist ready access to the airway, to optimize his or her own comfort and, most importantly, to enhance primary and accessory respiratory muscle function. Every effort should be made to keep the patient comfortable and to minimize (or, if possible, eliminate) environmental stimuli, especially the work noise generated by the surgical team.[5] The procedure is performed under local anesthetic. The patient is typically only minimally sedated to achieve patient comfort without compromising the ability to breathe spontaneously.[3] Another critical precaution to keep in mind is to avoid the use of a Bovie cautery in the presence of an oxygen rich gas mixture from the nasal cannula or the ventilating mask. This simple precautionary measure will avert the risk of igniting fire in the surgical field.

Awake fiberoptic nasotracheal intubation

Unless the fiberoptic laryngoscopy suggests otherwise, an "awake" fiberoptic nasotracheal intubation is often the procedure of choice. The OHNS is familiar with the view of the upper airway and glottis via routine flexible fiberoptic nasolaryngoscopy, and this intubation method allows one to use the same technique. On a patient who is awake, fiberoptic nasotracheal intubation is performed by passing a flexible bronchoscope through an endotracheal tube, then passing the endoscope transnasally to visualize the larynx. The endoscope is introduced into the subglottic trachea, and the endotracheal tube is then advanced over the endoscope. The endoscope is removed, the endotracheal tube is connected to the anesthesia circuit, and ventilation is confirmed. As a backup plan, one should have a Holinger laryngoscope, velvet-eye laryngeal suction, and Eschmann stylet assembled and ready to use. Often, the otolaryngologist can easily intubate a patient with these instruments. A ventilating rigid bronchoscope is also very helpful, if available. In addition, a tracheotomy tray should be open and ready to use. Injecting the soft tissue over the cricothyroid membrane with 1% lidocaine and 1:100,000 epinephrine ahead of time will result in vasoconstriction and a much drier operative field if emergency cricothyroidotomy or awake tracheotomy becomes necessary.

Other strategies for difficult intubation include retrograde intubation by placing a needle and guidewire (from a central line kit) into the cricothyroid membrane or trachea and passing the guidewire up and out of the mouth. An orotracheal tube may then be blindly passed over the guidewire and into the trachea. There are other techniques, usually used by the anesthetist, such as intubation thru a laryngeal mask airway or the use of a lighted stylet to be blindly introduced into the trachea.

Medically, there are helpful strategies to "buy time" or assess response to medical therapy if a patient can maintain ventilation. The patient is maintained in an intensive care

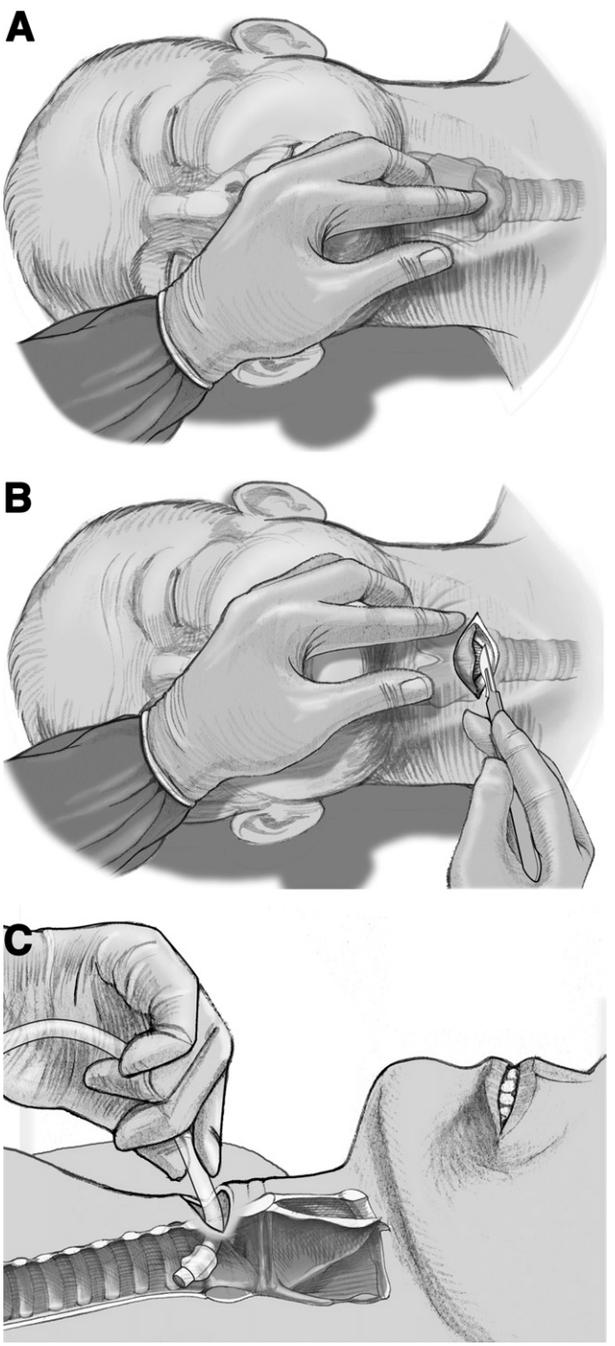

Figure 4 Emergency cricothyroidotomy technique. (A) Palpation of cricothyroid membrane. (B) Incision of skin and soft tissue to enter the airway. (C) Insertion of an endotracheal tube into the airway for ventilation.

unit setting with continuous pulse oximetry monitoring. Humidified oxygen (ie, via face tent) will help minimize secretions. Heliox has been advocated as a short-term intervention to help maximize ventilation while planning definitive intervention. Intravenous steroids (ie, dexamethasone 8 mg IV q 8 hours) may reduce airway edema. In some situations, appropriate medical treatment of the underlying problem, such as infection or angioedema, can obviate the need for intubation or surgical airway.

Summary

In summary, a logical and calm approach to the patient with a difficult airway can prevent poor outcomes. In the elective situation, identification of factors predisposing a difficult airway will enable proper planning before induction of anesthesia to prevent an emergency. In the urgent situation, a team approach following established algorithms under the leadership of the OHNS is recommended. It is important to have readily available alternate strategies to secure the airway if the initial approach is problematic.

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