Recognition and management of the difficult airway with special emphasis on the intubating LMA-Fastrach/whistle technique: a brief review with case reports

James M. Rich, CRNA, MA

OVERVIEW OF THE DIFFICULT AIRWAY

Difficult tracheal intubation using direct laryngoscopy may occur ubiquitously across the spectrum of health care (1–8) and is reported to occur with an incidence of approximately 6% in anesthesiology (9); nonetheless, most tracheal intubations can be performed using direct laryngoscopy. Difficult intubation occurs when multiple laryngoscopies, maneuvers, and/or blades are used by an experienced airway practitioner (10). Laryngoscopic views of the airway frequently associated with difficulty were originally defined by Cormack and Lehane (11) and generally reveal only 1) the epiglottis, 2) the tip of the epiglottis, 3) the posterior cartilages, or 4) soft pharyngeal tissue *(Table 1)*. Failed intubation occurs when the trachea cannot be intubated after multiple attempts. When intubation attempts are repeated beyond three or four times, the incidence of airway trauma and edema can increase and may ultimately create a critical airway event (1, 10) such as "cannot mask ventilate—cannot intubate" (CMVCI). If CMVCI occurs, rapid intervention using a supraglottic ventilation device is usually effective in restoring ventilation and oxygenation (1, 10). A number of supraglottic airways are now available *(Table 2)*; however, an analysis of their individual use is beyond the scope of this report. Supraglottic ventilation devices will generally provide better ventilation and protection from aspiration than that provided by bag-valve-mask ventilation (10). If ventilation cannot be established using a supraglottic airway device, transtracheal jet ventilation (15) or a cricothyrotomy is the standard

Table 1. Cormack and Lehane's laryngeal grades of the airway*

Grade	Visualized oral anatomy	Potential intubation implications
1	Entire glottic opening from the anterior to posterior commissure	Should facilitate an easy intubation
2	Just the posterior portion of glottis	Normally not difficult to pass a styleted endotracheal tube through the laryngeal aperture
3a†	Epiglottis only (epiglottis can be lifted using a laryngoscope blade)	Intubation is difficult but possible using a bougie introducer or flexible fiberoptic scope
3b†	Epiglottis only (but epiglottis cannot be lifted from the posterior pharynx using a laryngoscope blade)	Intubation can be difficult because insertion of a bougie introducer (e.g., gum elastic bougie) may be impeded, which can directly affect the successful use of a bougie introducer or a flexible fiberoptic scope
4†	Only soft tissue, with no identifiable airway anatomy	Difficult intubation, requiring advanced techniques to intubate the trachea

*From reference 11. For additional information on grades 1, 2, and 4, see reference 12; for additional information on grade 3, see reference 13. A laryngeal grade is obtained by direct laryngoscopy using a laryngoscope.

†Tracheal intubation normally requires an advanced airway technique beyond direct laryngoscopy.

Table 2. Adjunctive supraglottic ventilation devices*

Device	AHA/ILCOR† classification	Manufacturer
AMBU Laryngeal Mask	Not yet rated	AMBU, Glen Burnie, MD
Cobra PLA	Not yet rated	Engineered Medical Systems, Indianapolis, IN
Combitube	Class II-a‡	Tyco-Healthcare-Nellcor, Pleasanton, CA
EasyTube	Not yet rated	Rusch, Research Triangle Park, NC
Intubating Laryngeal Airway	Not yet rated	Mercury Medical, Clearwater, FL
King Laryngeal Tube	Not yet rated	King Systems, Noblesville, IN
Laryngoseal Laryngeal Mask	Not yet rated	Tyco-Healthcare-Nellcor, Pleasanton, CA
LMA-Classic	Class II-a‡	LMA North America, San Diego, CA
LMA-Fastrach	Not yet rated	LMA North America, San Diego, CA

*Based on references 1, 7, 14.

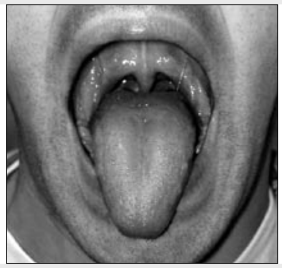
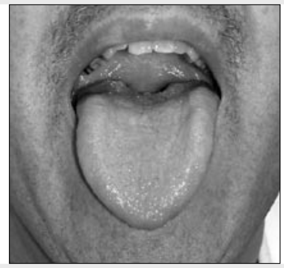
†AHA/ILCOR indicates American Heart Association/International Liaison Committee on Resuscitation. Devices are classified at the AHA/ILCOR conferences that are held every 5 years. Classification is based on review and discussion of research articles and case reports from the peer-reviewed literature. Many devices have been introduced since the last conference was held.

‡Class II-a denotes a therapeutic option for which the weight of evidence is in favor of its usefulness and efficacy.

From the Department of Anesthesiology and Pain Management, Baylor University Medical Center, Dallas, Texas.

Corresponding author: James M. Rich, CRNA, MA, Department of Anesthesiology and Pain Management, Baylor University Medical Center, 3500 Gaston Avenue, Dallas, Texas 75246 (e-mail: jrofdallas@aol.com).

Table 3. Mallampati airway classification system*

Mallampati class:	I	II	III	IV
Photographic example:				
Visualized intraoral anatomy:	Soft palate, fauces, uvula, anterior and posterior pillars	Soft palate, fauces, uvula	Only soft palate, base of uvula	The hard palate but not the soft palate
Implications:	Generally associated with an easy intubation	Generally associated with an easy intubation	Potential for intubation difficulty	Potential for intubation difficulty

*Based on references 16–19, 21. The Mallampati classification compares tongue size with the oropharyngeal space. To correctly perform the test, the patient must fully open the mouth and extend the tongue.

Table 4. The 6-D method of airway assessment*

Sign of difficulty	Description	Quantitative or qualitative findings reported to be associated with difficulty	Acceptable findings not usually associated with difficulty
1. Disproportion	—Increased size of tongue in relation to pharyngeal size	—Mallampati class III or IV	—Mallampati class I or II
2. Distortion	—Airway swelling —Airway trauma (blunt or penetrating) —Tissue consolidation (e.g., secondary to radiation) —Neck mass —Neck hematoma —Neck abscess —Arthritic changes in the neck joints —Previous surgical airway	—Possibly difficult to assess —Blunt or penetrating airway trauma —Tracheal deviation —Neck asymmetry —Voice changes —Subcutaneous emphysema (crepitus) —Laryngeal immobility —Nonpalpable thyroid cartilage —Nonpalpable cricoid cartilage	—Midline trachea —No contractures of the neck —No surgical airway scar —Mobile laryngeal anatomy —Easily palpated thyroid cartilage —Easily palpated cricoid cartilage
3. Decreased thyromental distance	—Anterior larynx and decreased mandibular space	—Thyromental distance <7 cm (<3 finger breadths) measured from the superior aspect of the thyroid cartilage to the tip of the chin —Receding chin	—Thyromental distance ≥7 cm (~3 finger breadths) —No receding chin
4. Decreased interincisor gap	—Reduced mouth opening	—Distance between upper and lower incisors (i.e., interincisor gap) <4 cm (<2 finger breadths) —Mandibular condyle fracture —Rigid cervical spine collar	—Interincisor gap ≥4 cm (~2 finger breadths)
5. Decreased range of motion in any or all of the joints of the airway (i.e., atlanto-occipital joint, temporomandibular joints, cervical spine); atlanto-occipital range of motion is critical for assuming the sniffing position	—Limited head extension secondary to arthritis, diabetes, or other diseases —Previous neck radiation and/or radical surgery —Neck contractures secondary to burns or trauma	—Head extension <35° —Neck flexion <35° —Short, thick neck —Cervical spine collar or cervical spine immobilization	—Head extension ≥35° of atlanto-occipital extension —Cervical spine flexion ≥35° —Long, thin neck —No cervical spine collar or cervical spine immobilization
6. Dental overbite	—Large angled teeth disrupting the alignment of the airway axes and possibly decreasing the interincisor gap	—Dental overbite	—No dental overbite

*Based on references 16–18, 21. The 6-D method of airway assessment helps practitioners remember to assess for each of the six signs that can be associated with a difficult intubation. Each sign begins with the letter *D* like the word *difficult*. The potential for difficult intubation is generally proportional to the number of signs observed.

Table 5. Techniques for difficult tracheal intubation

Difficult-airway intubation technique	Considerations/requirements
Awake laryngoscopic intubation (22)	± Judicious intravenous sedation (23) ± Topical anesthesia (23) Gentle use of the laryngoscope
Awake blind nasotracheal intubation (24)	± Judicious intravenous sedation (23) ± Topical anesthesia (23) Spontaneous ventilation ± Vasoconstrictor (23) ± Patil intubation guide or Beck Airway Airflow Monitor (24)
Intubating laryngeal mask airway in the awake patient	± Judicious intravenous sedation (23) ± Topical anesthesia (23) Chandy maneuver (25) Spontaneous ventilation ± Patil intubation guide or Beck Airway Airflow Monitor
Intubating laryngeal mask airway in the apneic patient	Chandy maneuver (25) Positive pressure ventilation
Retrograde intubation (26)	"Can mask ventilate—cannot intubate" situation ± Parker endotracheal tube ± Direct laryngoscopy
Indirect rigid fiberoptic laryngoscopy (27)	± Upsher, Wu, or Bullard laryngoscope (27)
Flexible fiberoptic laryngoscopy (28)	± General anesthesia ± Judicious intravenous sedation (23) ± Topical anesthesia (23) ± Spontaneous ventilation (28)
Lightwand intubation (27)	Should not be used in patients with pharyngeal masses or anatomic abnormalities of the upper airway (27)
Videolaryngoscopic devices (29)	GlideScope (29)
Malleable fiberoptic stylet	Shikani Seeing Stylet ± Direct laryngoscopy (30)

Table 6. Intubation rescue techniques*

- External laryngeal manipulation (ELM) on the thyroid cartilage (31)
- Backward upward rightward pressure (BURP) on the thyroid cartilage (32)
- Lever-tip (McCoy-type) laryngoscope (33)
- Head-elevated laryngoscopy position (HELP) (34, 36)
- Assessment for proper degree of muscle paralysis
- Changing the blade length (e.g., change #2 Miller to #3 Miller) (15)
- Changing the blade type (e.g., change curved to straight) (15)
- Changing the operator (one with more experience or better access)
- Bougie-assisted intubation (e.g., gum elastic bougie) (27, 37)
- Combined use of a lever-tip laryngoscope and bougie introducer for patients requiring cervical spine precautions or the neutral head position (33)

*Based on references 15, 27, 31–37.

method to provide oxygenation and avoid disability or death (7). Ready availability of necessary adjunctive devices is paramount to prevent complications resulting from failed management of the airway (7).

ASSESSMENT AND RECOGNITION OF THE DIFFICULT AIRWAY

Preanesthetic assessment of the airway is recommended to predict the presence of a difficult airway before beginning airway management. The Mallampati classification system was implemented as a method to predict difficult intubation. However, its reliability as a predictor of difficult intubation has been questioned (20), and it assesses only one aspect of the airway for difficulty (i.e., intraoral disproportion) (16) *(Table 3)*. A comprehensive airway examination incorporates both quantitative and qualitative tests that together may increase the probability of predicting difficult intubation (21). One such system, the "6-D" method, was expanded by the author from a previously described method of airway assessment (18). It examines the airway for six separate signs that can be associated with difficult intubation: 1) disproportion, 2) distortion, 3) decreased thyromental distance, 4) decreased interincisor gap, 5) decreased range of motion, and 6) dental overbite. The 6-D assessment method helps in remembering the six signs because like the word *difficult*, each sign begins with the letter *D* (*Table 4*). The potential for a difficult intubation is generally related to the number of signs that are present. Regardless of the method of airway evaluation, it is important to understand that airway assessment is not infallible and can produce both false-negative and false-positive signs of difficult intubation.

Nonetheless, airway examination is beneficial in that it can alert practitioners to the presence of a potentially difficult intubation, thus allowing them either 1) to attempt intubation using a difficult-airway intubation technique from the outset *(Table 5)* or 2) to proceed using a standard direct laryngoscopy technique while simultaneously being prepared to apply an intubation rescue technique *(Table 6)* or an adjunctive ventilation technique (Table 2) should intubation or ventilation prove to be difficult. The choice of a difficult-airway intubation technique is dependent on the clinical situation and the practitioner's familiarity and skill in using any particular device. Not every difficult airway technique must be learned or mastered, but it is best to be familiar with more than one technique in order to increase the likelihood of success.

Intubation rescue techniques may assist with either an anticipated or unanticipated difficult intubation. Intubation rescue is used following a failed intubation attempt, provided that 1) no more than several laryngoscopic attempts have been made, 2) laryngoscopy has been attempted for <10 minutes, and 3) the patient's SpO_2 can be maintained at >92% (1, 7, 10). If laryngoscopy has been attempted for >10 minutes or >3 times or the patient's SpO_2 cannot be maintained at >92%, intubation attempts should be aborted and emergency ventilation using a Combitube, LMA, or other Food and Drug Administration–approved supraglottic airway device (Table 2) should be used until a definitive airway can be safely inserted using a different

Figure 1. The intubating laryngeal mask airway with Euromedical endotracheal tube, stabilizing rod, and syringes.

technique (1). If the clinical situation permits, the patient may be awakened and the surgical case postponed.

When a difficult airway is suspected, it is recommended to secure the airway with the patient awake (38), unless it is contraindicated (23). Various difficult-airway intubation techniques are currently available (Table 5), and most can be performed with the patient awake while receiving a combination of intravenous sedation and topical local anesthesia of the airway.

OVERVIEW OF THE LMA-FASTRACH/WHISTLE TECHNIQUE

The intubating laryngeal mask airway (ILMA) is known as the LMA-Fastrach (LMA North America, San Diego, CA) in the USA and elsewhere as the ILMA. It was designed especially for ventilation and intubation of patients with a difficult airway *(Figure 1)*. The ILMA is inserted orally to a depth where it rests upon the supraglottic laryngeal structures of the upper airway. A seal is produced when the mask is inflated, allowing the patient to either breathe spontaneously or be ventilated manually via the ILMA tube. The ILMA is unique in that it provides both a means for lung ventilation as well as a seamless bridge to tracheal intubation.

The Chandy maneuver *(Figure 2)* was developed by Dr. Chandy Verghese and significantly improves the effectiveness of the ILMA (25). It incorporates two maneuvers that improve lung ventilation and tracheal intubation using the ILMA. Part one of the Chandy maneuver facilitates positioning of the ILMA in the upper airway so that lung ventilation is maximized through the device. This is done by grasping the ILMA by the handle and moving it back and forth in the sagittal plane while observing the patient's tidal volume and/or the capnographic waveform (if ventilation is being controlled manually). However, if the patient is breathing spontaneously, an airway whistle (e.g., Patil intubation guide [Anesthesia Associates, San Marcos, CA] or Beck Airway Airflow Monitor [Great Plains Ballistics, Lubbock, TX]) can be attached to the proximal portion of the ILMA to optimize ventilation through it. The whistle will sound with each breath

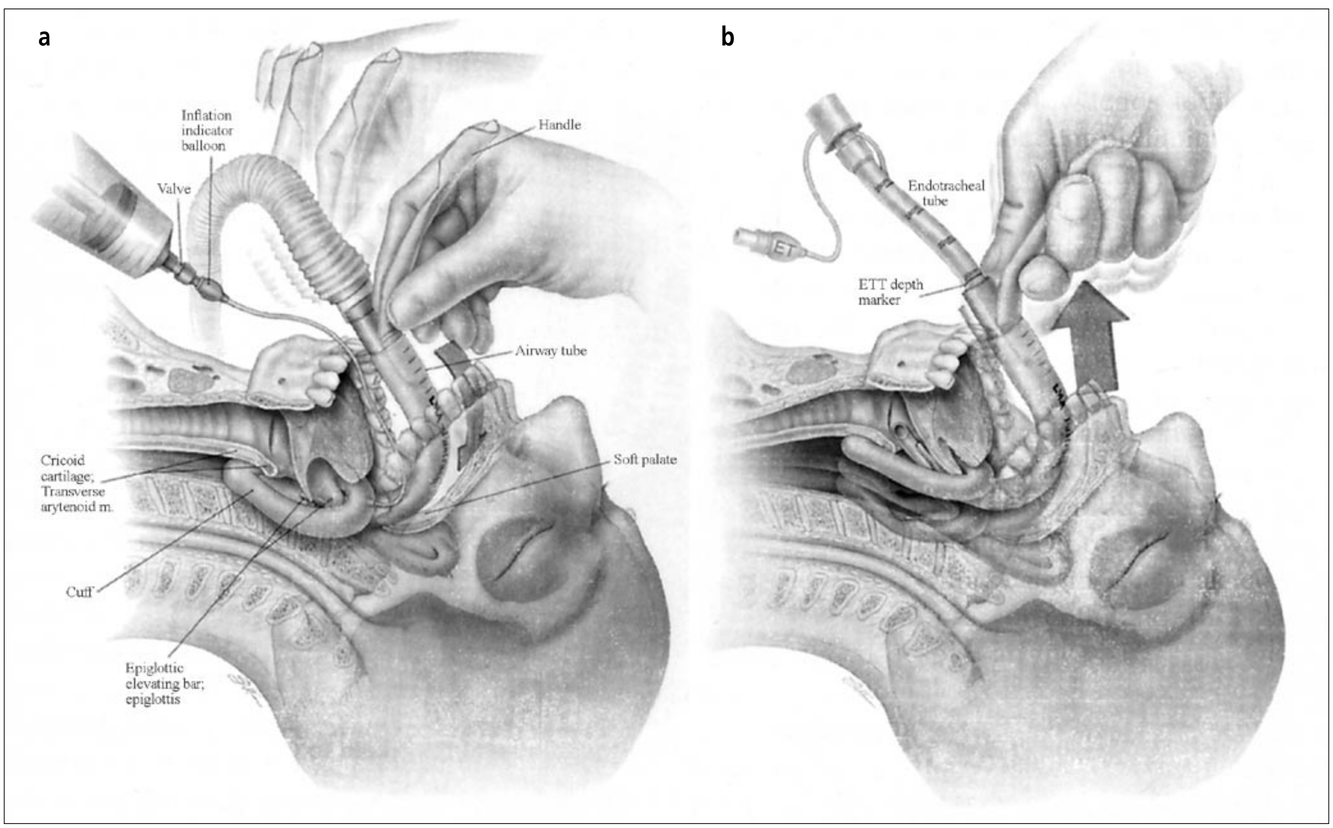


Figure 2. The two steps of the Chandy maneuver. **(a)** After insertion of the LMA-Fastrach, optimal ventilation is established by slightly rotating the device in the sagittal plane, using the metal handle, until the least resistance to bag ventilation is achieved. This helps to align the internal aperture of the device with the glottic opening. **(b)** Just before blind intubation, the LMA-Fastrach is slightly lifted (but not tilted) away from the posterior pharyngeal wall using the metal handle. This prevents the endotracheal tube (ETT) from colliding with the arytenoids and facilitates the smooth passage of the ETT into the trachea. Reprinted from reference 25 with permission.

the patient takes. The ILMA is then moved slowly back and forth in the sagittal plane using part one of the Chandy maneuver until maximal whistling is attained. Maximal whistling indicates optimal positioning of the ILMA. The second part of the Chandy maneuver involves aligning the ILMA to facilitate smooth passage of the endotracheal tube (ETT) into the trachea.

A special Euromedical ETT is provided with the ILMA. The ETT has a longitudinal line, which should be oriented to face the patient's nose superiorly. Proper orientation of the longitudinal line causes the ETT to exit the ILMA at an angle that eases its passage into the trachea. The ETT also has a circumferential line at a distance from the distal tip of the ETT that is equal to the length of the ILMA from the proximal to the distal port. At the point where the circumferential line is advanced to the proximal port of the ILMA, the distal tip of the ETT will be in contact with the epiglottic elevator bar (which covers the distal port of the ILMA). The epiglottic elevator bar raises the epiglottis so that the ETT can enter the glottis unimpeded. Just before the distal tip of the ETT contacts the epiglottic elevator bar, the second part of the Chandy maneuver is performed. This involves lifting the handle of the ILMA at a 45° angle to the patient's chest. This helps align the trajectory of the ETT into the trachea inferiorly and usually facilitates smooth passage of the ETT into the trachea.

If the patient is breathing spontaneously, an airway whistle attached to the proximal end of the ETT will sound with each ventilation. As the tip of the ETT enters the trachea, the volume of the whistle increases. When the cuff of the ETT is inflated, the volume of the whistle will increase even more, heralding the sealing of the ETT within the trachea and securement of the patient's airway. Tracheal intubation should always be confirmed with an evidence-based method, using a carbon dioxide detector if the patient has a perfusing cardiac rhythm or a self-inflating bulb if the patient does not have a perfusing cardiac rhythm (39). Additionally, auscultation of bilateral breath sounds will confirm that the ETT is lying in a midtracheal position. The ILMA can then be removed over the ETT using the stabilizing rod (Figure 1) or left in place with the mask deflated until the trachea is extubated.

CASE REPORTS

This article describes four patients who after preanesthetic assessment were suspected of having difficult-to-manage airways. Two of the patients were morbidly obese and two were thin. All four patients had an American Society of Anesthesiologists (ASA) physical status ≥3. The first three patients were receiving anesthesia care for surgical procedures, and the fourth patient was intubated emergently in the emergency department for acute respiratory failure. The three surgical patients had routine ASA monitors applied in the operating room. Patients #1 and #3 were also monitored using a PSA 4000 Patient State Analyzer (Physiometrix, Inc, N. Billerica, MA) and direct arterial blood pressure. Capnography was not available in the emergency department for patient #4; however, intubation was confirmed using a colorimetric carbon dioxide detector. All patients received supplemental oxygen, intravenous sedation, and topical local anesthesia of their airways before insertion of the ILMA. A Patil intubation guide (i.e., airway whistle) was used to confirm optimal positioning of the ILMA in each patient and to monitor advancement of the ETT through the ILMA *(Figure 3)*. Three of the patients were intubated through the ILMA using intravenous sedation and topical local anesthesia of the airway. Patient #2 also received general inhalation anesthesia (i.e., sevoflurane) after insertion of the ILMA and prior to tracheal intubation. Tracheal intubation was confirmed in each patient using the presence of end-tidal carbon dioxide and auscultation of bilateral breath sounds.

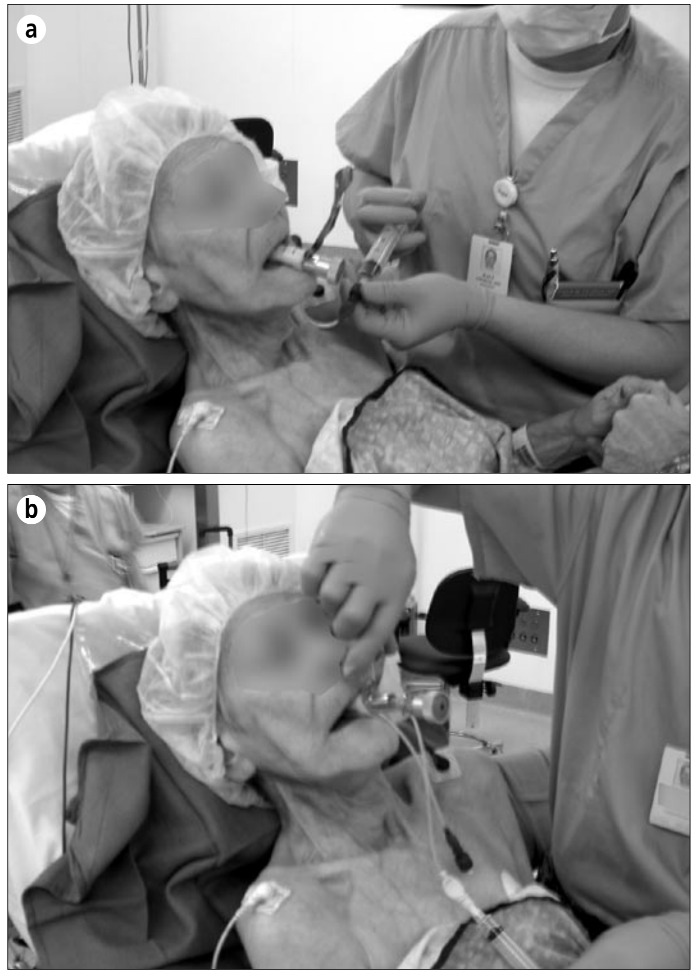


Figure 3. (a) An intubating laryngeal mask airway (ILMA) has been inserted in the patient with a Patil whistle attached. **(b)** An endotracheal tube with a Patil whistle has been advanced into the trachea via the ILMA.

Case #1

A 72-year-old white woman presented for left vertebral to carotid artery transposition and left carotid-axillary bypass surgery. She was 5 feet 7 inches (170 cm) and weighed 98 lb (44.5 kg) (body mass index [BMI] = 15.3 kg/m^2). Previous medical history was significant for smoking, hypertension, vertebral-basilar transient ischemic attacks, chronic obstructive pulmonary disease, nocturnal use of oxygen, and right radical neck dissection with radiation 5 years previously. Medications included clonidine, amlodipine, and lisinopril. Vital signs were stable.

Her airway examination revealed neck asymmetry and laryngeal immobility. Mouth opening demonstrated a Mallampati class II airway, and neck range of motion appeared adequate *(Figure 4)*. After receiving preoperative beta-blockers according to protocol, she was prepared for an awake laryngoscopic assess-

Figure 4. Neck asymmetry and mouth opening in patient #1.

Figure 5. Insertion of a #4 intubating laryngeal mask airway.

ment and received incremental intravenous doses of midazolam (total dose 2 mg) and fentanyl (total dose 100 μg). She gargled with 4% topical lidocaine and then tolerated oral insertion of a soft nasal airway coated with 5% lidocaine ointment over its internal and external surface (i.e., lidocaine lollipop). A right radial artery catheter was placed to closely monitor her cardiovascular response to laryngoscopy. An awake laryngoscopy was well tolerated but revealed only a Cormack and Lehane grade 4 view (Table 1) (11).

At this point, insertion of a #4 ILMA coated with a small amount of 5% lidocaine ointment and with a Patil intubation guide attached was well tolerated *(Figure 5)*. Upon inflation of the ILMA mask, the Patil intubation guide (Figure 3) immediately began to produce whistling with inhalation and exhalation. The ILMA was manipulated in the airway using the Chandy maneuver (Figure 2) to optimally position it so as to produce the loudest volume of whistling. A #7 Euromedical ETT with the Patil intubation guide attached was easily inserted through the ILMA and advanced into the trachea (Figure 3). Whistling volume increased with passage of the ETT through the glottis and further increased after inflation of the ETT cuff. No coughing occurred with ETT insertion into the trachea; however, the patient's blood pressure rose from 140/50 to 170/70 mm Hg. The blood pressure returned to normal after administration of nicardipine 500 mg followed by esmolol 30 mg. The patient took deep breaths upon command throughout the intubation process. She was subsequently anesthetized with general anesthesia, and the case proceeded uneventfully. She was extubated awake shortly after discontinuation of the anesthetic and recovered without incident.

Case #2

A 63-year-old morbidly obese Hispanic woman with an ASA physical status of 3 presented for repair of a left femoral arteriovenous fistula/pseudoaneurysm. Previous medical history included end-stage renal disease, hypertension, insulin-dependent diabetes mellitus, and use of nocturnal continuous positive airway pressure for airway support. Medications included omeprazole, warfarin (none for 24 hours), insulin, and diltiazem. SpO_2 was 89% on room air and vital signs were stable. Laboratory results were within normal limits, with the exception of creatinine (5.1 mg/dL) and blood glucose by finger stick (164 mg/dL). Her height was 4 feet 5 inches (135 cm) and weight, 196 lb (89 kg) (BMI = 49.1 kg/m^2). Airway examination revealed a Mallampati class IV; mouth opening <2 finger breadths; significant dental overbite; thyromental distance <2 finger breadths; and no extension at the atlanto-occipital joint.

She received preoperative beta-blockers according to protocol as well as tight glycemic control intraoperatively. Incremental intravenous 2-mg doses of midazolam were administered over 5 to 10 minutes until the patient accepted oral insertion of the ILMA. During the preintubation period, her oropharynx and airway were anesthetized with incremental doses of 2% Cetacaine spray (Cetylite Industries, Pennsauken, NJ). A #4 ILMA was inserted using the method described for patient #1. After establishing optimal ILMA positioning, the whistle was removed and the breathing circuit was attached to the ILMA, whereupon the patient breathed sevoflurane with 100% oxygen until a suitable end-tidal level was obtained. She was then intubated in a similar fashion as described for patient #1. Upon cessation of general anesthesia, she met criteria for extubation; however, she became somnolent shortly after extubation (Ramsay Sedation Scale score = 4) (40), for which she was treated with and responded well to flumazenil. Recovery was otherwise uneventful.

Case #3

A 53-year-old white man presented for right carotid-subclavian bypass angioplasty. Medications included atorvastatin, levothyroxine, atenolol, bupropion, and methylprednisolone SR. He weighed 150 lb (68 kg) and was 5 feet 9 inches tall (175 cm) (BMI = 22.1 kg/m^2). His laboratory results were within normal limits and his vital signs were stable. His previous medical history was significant for hypertension, peripheral vascular disease, and smoking. He had a distant history of pharyngeal cancer, which was diagnosed and treated with surgery and radiation at age 12. A tissue flap on his anterior neck prevented palpation of any laryngeal anatomy, and there was essentially a straight line of tissue from one finger breadth posterior to the tip of the chin to the base of his neck. He had decreased neck range of motion; however, he demonstrated a Mallampati class II airway. He received preoperative beta-blockers according to protocol.

The patient was counseled for an awake laryngoscopy with intravenous sedation and topical local anesthesia of the airway. He was sedated with incremental doses of midazolam and fentanyl. He gargled 2% viscous lidocaine, and his oropharynx was sprayed with 2% Cetacaine. He tolerated oral insertion of a soft nasal trumpet coated with 5% lidocaine ointment over the inner and outer surfaces (i.e., lidocaine lollipop). He followed commands, opened his mouth, and tolerated insertion of a #3 MacIntosh laryngoscope blade. Only soft tissue with no recognizable airway anatomy was visible (i.e., Cormack and Lehane grade 4 laryngoscopic view [Table 1]). His only reaction to laryngoscopy was a slight increase in his ventilatory rate. His airway was then managed as described for patient #1. The case proceeded uneventfully, and he was extubated awake shortly after the procedure, recovering without incident.

Case #4

The anesthesia service was requested to perform an emergency tracheal intubation on a 33-year-old morbidly obese (5 feet 7 inches [170 cm], 465 lb [211 kg], BMI = 72.8 kg/m^2) black woman in the emergency department. Her previous medical history was significant for asthma, congestive heart failure, stable cardiomegaly, hypertension, non–insulin-dependent diabetes mellitus, sleep apnea, previous cerebrovascular accident, and use of supplemental oxygen with bilevel positive airway pressure respiratory support. She was chronically bedridden, was nonambulatory, and had pneumonia with acute respiratory failure. Because of carbon dioxide narcosis, she was arousable only to noxious stimuli (Ramsay scale = 5) (40). She was receiving oxygen by nonrebreathing mask. Her arterial blood gas revealed pH, 7.28; PCO_2, 72 mm Hg; PO_2, 67 mm Hg; arterial oxygen saturation, 92%; base deficit, +4; bicarbonate, 33 mEq/L. Her blood sugar was 119 mg/dL and SpO_2 was 90%. Airway assessment was limited due to her supine position and critical condition. She was noted to have a large tongue, and her airway was assumed to be difficult because of her morbid obesity.

The decision was made to intubate her using an ILMA with spontaneous ventilation. A difficult-airway cart with additional devices was immediately available in case rescue ventilation or a cricothyrotomy was needed (1, 10). Her tidal volume was adequate, and her respiratory rate was >20 breaths/minute secondary to her elevated arterial carbon dioxide level. Oxygen and nebulized 4% lidocaine were administered by mask over a 15-minute period before airway management began. Glycopyrrolate 0.4 mg was administered for its antisialagogue effect to increase tissue contact of the topical lidocaine. Two doses of intravenous midazolam in 2-mg increments were administered over a period of several minutes just prior to insertion of a #5 ILMA.

Upon initial insertion of the ILMA, the patient reacted by coughing. The ILMA was removed, and supplemental 2% Cetacaine spray was administered orally along with an additional 2 mg of midazolam. After several minutes she tolerated reinsertion of the ILMA, and her airway was subsequently managed as described for patient #1. Advancement of the ETT into the trachea produced a large cough. Tracheal intubation was quickly confirmed using a colorimetric carbon dioxide detector, whereupon anesthesia was induced using etomidate 20 mg. She was then paralyzed with vecuronium and received a propofol infusion for postintubation management. Additionally, she was placed on a ventilator with controlled ventilation. She remained intubated for some time and eventually received a tracheostomy some days later. Her mental status eventually recovered to her usual preadmission level (Ramsay scale = 1 to 2) (40). She was eventually weaned from the ventilator and subsequently transferred to a rehabilitation hospital.

DISCUSSION

Three of these high-risk patients were intubated using intravenous sedation and topical local anesthesia of the airway while breathing spontaneously through the ILMA attached to a Patil intubation guide (4, 41). One patient (case #2) was administered sevoflurane via the ILMA prior to tracheal intubation. The use of the ILMA allowed for maintenance of optimal oxygenation and ventilation and provided a seamless bridge to tracheal intubation. Airway management using an "awake" technique was chosen because of the inherent safety associated with its use (22, 38).

The author's familiarity and skill using the ILMA was a key factor in selecting it for these patients suspected of having difficult-to-manage airways (38). Other techniques may have worked equally well (Table 5). The ILMA offered a thorough means of oxygenation and ventilation. Proper placement of the ILMA was facilitated by positioning it until maximal whistling was ascertained via the Chandy maneuver. Observation of an optimal capnographic waveform coupled with maximal tidal volume will also demonstrate proper positioning of the ILMA prior to insertion of the ETT. However, maximal volume of the whistle is simpler to produce and determine. Additionally, the operator's attention is less likely to be diverted away from the patient's airway, as may happen when attempting to simultaneously observe the capnograph and tidal volume. The safety of awake intubation using judicious sedation and topical anesthesia is recommended and well established (22, 38, 42). Anesthesia induction with muscle paralysis could have proven disastrous in the morbidly obese woman described in case #4. The "cannot mask ventilate—cannot intubate" situation has been previously reported in morbidly obese patients (7, 43).

This report of airway management in four patients suspected of having difficult-to-manage airways together with previous reports describing the use of the ILMA/whistle technique in both the prehospital environment (4) and the intensive care unit (41) suggests that this difficult-airway intubation technique may provide a viable option for "awake" tracheal intubation in virtually any location where airway management is performed. Additionally, this report demonstrates that the ILMA can be well tolerated in sedated patients who are breathing spontaneously and appropriately prepared for this method of tracheal intubation.

1. Rich J. Street Level Airway Management (SLAM): if your patient can't breathe—nothing else matters. *Anesthesia Today* 2005;16:13–22. Available at http://www.airwayeducation.com/PDFs/Anesthesia_Today_16_2005.pdf; accessed May 16, 2005.
2. Katz SH, Falk JL. Misplaced endotracheal tubes by paramedics in an urban emergency medical services system. *Ann Emerg Med* 2001;37:32–37.
3. Knacke A. Fallbeispiel: Atemwegsmanagement bei eingeklemmtem Polytrauma-Patienten [Case report: Prehospital airway management of a trapped person with polytrauma]. *Rettungsdienst* 2001;24:994–996.

4. Mason AM. Use of the intubating laryngeal mask airway in pre-hospital care: a case report. *Resuscitation* 2001;51:91–95.
5. Mason A. The laryngeal mask airway (LMA) and intubating laryngeal mask airway (ILMA) in prehospital trauma care. Presented at the meeting of the Royal College of Anaesthetists, London, May 13, 2002.
6. Peterson GN, Posner KL, Domino KB, Lee L, Caplan RA, Cheney FW. Management of the difficult airway in closed malpractice claims [poster]. Annual Meeting of the American Society of Anesthesiologists, San Francisco, 2003. Available at http://depts.washington.edu/asaccp/annualmeeting/2003_ASA_Airway_Poster.pdf; accessed May 16, 2005.
7. Rich JM, Mason AM, Bey TA, Kraft P, Frass M. The critical airway, rescue ventilation, and the Combitube: part 1. *AANA J* 2004;72:17–27. Available at http://www.airwayeducation.com/PDFs/AANA_ARTICLE_2-04.pdf; accessed May 16, 2005.
8. Rich JM, Mason AM, Bey TA, Kraft P, Frass M. The critical airway, rescue ventilation, and the Combitube: part 2. *AANA J* 2004;72:115–124. Available at http://www.airwayeducation.com/PDFs/AANA_ARTICLE_4-04.pdf; accessed May 16, 2005.
9. Crosby ET, Cooper RM, Douglas MJ, Doyle DJ, Hung OR, Labrecque P, Muir H, Murphy MF, Preston RP, Rose DK, Roy L. The unanticipated difficult airway with recommendations for management. *Can J Anaesth* 1998;45:757–776.
10. Rich JM, Mason AM, Ramsay MAE. The SLAM Emergency Airway Flowchart: a new guide for advanced airway practitioners. *AANA J* 2004;72:431–439. Available at http://www.airwayeducation.com/PDFs/flowchart_AANA_journal_course.pdf; accessed May 16, 2005.
11. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. *Anaesthesia* 1984;39:1105–1111.
12. Benumof JL. Definition and incidence of the difficult airway. In Benumof JL, ed. *Airway Management: Principles and Practice*. St. Louis: Mosby, 1996:121–125.
13. Henderson J, Popat M, Latto P, Pearce A. Difficult Airway Society guidelines for management of the unanticipated difficult intubation. *Anaesthesia* 2004;59:675–694.
14. Barnes TA, Macdonald D, Nolan J, Otto C, Pepe P, Sayre MR, Shuster M, Zaritsky A; American Heart Association; International Liaison Committee on Resuscitation. Cardiopulmonary resuscitation and emergency cardiovascular care. Airway devices. *Ann Emerg Med* 2001;37(4 Suppl):S145–S151.
15. Benumof JL, Scheller MS. The importance of transtracheal jet ventilation in the management of the difficult airway. *Anesthesiology* 1989;71:769–778.
16. Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiberger D, Liu PL. A clinical sign to predict difficult tracheal intubation: a prospective study. *Can Anaesth Soc J* 1985;32:429–434.
17. Mallampati SR. Recognition of the difficult airway. In Benumof JL, ed. *Airway Management: Principles and Practice*. St. Louis: Mosby, 1996:126–142.
18. Mallampati S. Clinical assessment of the airway. *Anesthesiol Clin North Am* 1995;13:301–308.
19. Samsoon GL, Young JR. Difficult tracheal intubation: a retrospective study. *Anaesthesia* 1987;42:487–490.
20. Karkouti K, Rose DK, Ferris LE, Wigglesworth DF, Meisami-Fard T, Lee H. Inter-observer reliability of ten tests used for predicting difficult tracheal intubation. *Can J Anaesth* 1996;43:554–559.
21. Wilson W. Difficult intubation. In Atlee J, ed. *Complications in Anesthesia*. Philadelphia: WB Saunders, 1999:138–147.
22. Benumof JL. Management of the difficult adult airway. With special emphasis on awake tracheal intubation. *Anesthesiology* 1991;75:1087–1110.
23. Sanchez A, Morrison D. Preparation of the patient for awake intubation. In Hagberg C, ed. *Handbook of Difficult Airway Management*. Philadelphia: Churchill Livingstone, 2000:49–82.
24. Beck GP. Blind nasal intubation. *Emerg Med Serv* 2002;31:79.
25. Ferson DZ, Rosenblatt WH, Johansen MJ, Osborn I, Ovassapian A. Use of the intubating LMA-Fastrach in 254 patients with difficult-to-manage airways. *Anesthesiology* 2001;95:1175–1181.
26. Sanchez A, Pallares V. Retrograde intubation technique. In Benumof JL, ed. *Airway Management: Principles and Practice*. St. Louis: Mosby, 1996:320–341.
27. Minkowitz H. Airway gadgets. In Hagberg C, ed. *Handbook of Difficult Airway Management*. Philadelphia: Churchill Livingstone, 2000:149–169.
28. Ovassapian A, Wheeler M. Flexible fiberoptic tracheal intubation. In Hagberg C, ed. *Handbook of Difficult Airway Management*. Philadelphia: Churchill Livingstone, 2000:83–114.
29. Cooper RM, Pacey JA, Bishop MJ, McCluskey SA. Early clinical experience with a new videolaryngoscope (GlideScope) in 728 patients. *Can J Anaesth* 2005;52:191–198.
30. Agro F, Cataldo R, Carassiti M, Costa F. The Seeing Stylet: a new device for tracheal intubation. *Resuscitation* 2000;44:177–180.
31. Benumof JL. Conventional (laryngoscopic) orotracheal and nasotracheal intubation (single-lumen tube). In Benumof JL, ed. *Airway Management: Principles and Practice*. St. Louis: Mosby, 1996:261–276.
32. Knill RL. Difficult laryngoscopy made easy with a "BURP." *Can J Anaesth* 1993;40:279–282.
33. Smith CE. Cervical spine injury and tracheal intubation: a never-ending conflict. *TraumaCare* 2000;10(1):20–26. Available at http://www.airwayeducation.com/PDFs/SpringSummer_2000.pdf; accessed May 16, 2005.
34. Levitan RM, Mechem CC, Ochroch EA, Shofer FS, Hollander JE. Head-elevated laryngoscopy position: improving laryngeal exposure during laryngoscopy by increasing head elevation. *Ann Emerg Med* 2003;41:322–330.
35. Levitan R. Rescuing intubation. Simple techniques to improve airway visualization. *JEMS* 2001;26:36–42, 44–46, 48–49.
36. Rich JM. Use of an elevation pillow to produce the head-elevated laryngoscopy position for airway management in morbidly obese and large-framed patients [letter]. *Anesth Analg* 2004;98:264–265.
37. Latto I. Management of difficult intubation. In Latto I, Vaughan R, eds. *Difficulties in Tracheal Intubation*. London: WB Saunders, 1997:107–160.
38. Benumof J. The ASA Difficult Airway Algorithm: new thoughts and considerations. In Hagberg C, ed. *Handbook of Difficult Airway Management*. Philadelphia: Churchill Livingstone, 2000:31–48.
39. de Latorre F, Nolan J, Robertson C, Chamberlain D, Baskett P; European Resuscitation Council. European Resuscitation Council Guidelines 2000 for Adult Advanced Life Support: a statement from the Advanced Life Support Working Group and approved by the Executive Committee of the European Resuscitation Council. *Resuscitation* 2001;48:211–221.
40. Ramsay MA, Savege TM, Simpson BR, Goodwin R. Controlled sedation with alphaxalone-alphadolone. *Br Med J* 1974;2:656–659.
41. Osborn IP. The intubating laryngeal mask airway (ILMA) is assisted by an old device. *Anesth Analg* 2000;91:1561–1562.
42. Sanchez A, Trivedi NS, Morrison DE. Preparation of the patient for awake intubation. In Benumof JL, ed. *Airway Management: Principles and Practice*. St. Louis: Mosby, 1996:159–182.
43. Della Puppa A, Pittoni G, Frass M. Tracheal esophageal Combitube: a useful airway for morbidly obese patients who cannot intubate or ventilate. *Acta Anaesthesiol Scand* 2002;46:911–913.