Managing the Difficult Airway in Craniomaxillofacial Trauma

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ABSTRACT

Securing the airway in the patient with craniomaxillofacial trauma can be an extremely difficult challenge for health care practitioners. This article provides several approaches to airway management. Presented here are several options for securing the airway under a variety of conditions and scenarios.

KEYWORDS: Facial trauma, airway trauma, difficult airway, craniomaxillofacial trauma, securing the airway

Securing an airway on patients suffering from craniomaxillofacial trauma (CMT) often presents a most difficult challenge to any health care professional. From anesthesiologists in the operating room to paramedics in the field, many different disciplines involved with emergency care face an array of problems trying to secure an airway in victims of CMT. In this article, I discuss managing and securing the difficult airway in a spontaneously ventilating patient without much emphasis on how to secure an emergency airway on an apneic patient. Resorting to a cricothyrotomy will always remain an option. Some of the techniques described may only serve to buy time until someone qualified can perform a formal tracheotomy. I present a variety of common scenarios and provide solutions that have helped physicians in my hospital and other experts secure an airway under difficult circumstances.

Before introducing specific airway scenarios, one needs to be reminded of a few basic facts. When assessing a traumatized patient, every practitioner must always apply the ABCs (airway, breathing, and circulation) of triage. A point of caution for all practitioners is to remember to frequently reevaluate the airway. Timely airway intervention can avoid the development of a very difficult airway later. A previously unobstructed airway can quickly change to an emergency situation. Several symptoms may provide clues that the clinical situation regarding the airway have changed and intervention may be necessary. A patient who was previously talking or phonating clearly but becomes slightly hoarse or whose voice has changed may be developing laryngeal edema, compromising the airway. Changes to the breathing pattern or the "noise" of breathing might also indicate the potential for pending airway compromise. Because the narrowest part of any airway in most humans is at the vocal cords (in newborns and very small children, the narrowest part is the cricoid cartilage), it does not take much edema to the vocal cords or the epiglottis to precipitate an airway emergency. Such patients will need immediate airway evaluation with a low threshold to secure the airway before acute airway deterioration develops.

ASSESSING THE AIRWAY

Prior to any decisions regarding airway management, the practitioner must take into account several aspects of the airway. When approaching any possible airway

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intervention, all practitioners need to assess several factors quickly: (1) Does the patient need an airway now? If not, how much time is necessary to secure an airway? (2) If there is time, what anatomic (nasal, oral, tracheotomy) approach should be used? (3) What device or devices would best suit this particular patient? (4) How should the chosen device be employed? (5) Should a sedative or a muscle relaxant be used on this patient, or should the airway be secured while the patient is awake? (6) What if plan A doesn't work? (7) Is there a cervical spine injury? If so, how should the cervical spine be protected while securing the airway? When the practitioner has considered all of the above, a coherent plan to secure the airway can be generated.

When the patient needs an immediate airway for whatever reason, the practitioner should utilize the approach he or she is most comfortable with that will accomplish the task at hand. The emergency tracheotomy should only be employed by those skilled at the procedure or in dire emergencies. If the practitioner chooses to perform a tracheotomy, it should be remembered that any airway is better than no airway, and a small endotracheal tube (ETT) can be later converted to something more appropriate under controlled circumstances. Discussed below are several maneuvers as well as several devices to facilitate intubating patients.

If an artificially secured airway is not immediately needed and the practitioner has determined that there is time, the patient's specific clinical situation will dictate how to proceed. In general, the first step on the decision tree should involve determining whether a nasal or oral approach should be used. Assessing the extent of intracranial trauma in the field is difficult at best even under optimal circumstances. Consequently, practitioners should avoid a nasal approach to securing the airway unless they are certain there is no intracranial trauma involving the cribriform plate.[1,2]

There are numerous publications touting the safety and efficacy of sedating/paralyzing patients to secure the airway.[3,4] Few if any of these publications specifically address the patient with CMT. The decision to sedate/paralyze patients with CMT remains controversial. Ultimately, the choice to sedate/paralyze rests with the practitioners and their level of training, skill, and comfort. Practitioners should remember that sedating a traumatized patient might precipitate a significant drop in blood pressure and diminish or remove the patient's respiratory drive, as well as decrease the patient's ability to protect their own airway. Extreme caution must be taken any time one considers sedating a trauma patient, and preparations must be in place to treat unintended side effects.

DEVICES USED TO SECURE THE AIRWAY

There are numerous devices available to assist the practitioner in securing an airway. The following list includes the devices I recommend for securing any airway, including the patient with craniofacial trauma. These devices and their utilization are discussed individually in the sections on specific clinical situations.

Besides the usual array of oral airways, laryngoscope blades, handles, and ETTs, at our hospital we utilize all of these airway devices:

1. Adult fiber-optic bronchoscope (FOB)
2. Pediatric FOB
3. Laryngeal mask airway (LMA; LMA International, San Diego, CA), all sizes
4. Portex tracheal tube guide (PTTG; Smiths Medical ASD, Inc., Keene, NH), sizes 11-French and 15-French
5. Cook Aintree Intubation Catheter (Cook, Inc., Bloomington, IN)
6. Cook Airway Exchange Catheter (Cook, Inc.), size 19-French
7. Hudson Ovassapian Airway (Hudson Respiratory Care, Inc., Temecula, CA)
8. Kendall Argyle Nasopharyngeal Airway (Tyco Healthcare Group, LP, Mansfield MA)
9. McGill forceps
10. Hudson RCI MICRO MIST nebulizer for xylocaine HCl (Hudson Respiratory Care, Inc., Temecula, CA)
11. Teeth Guard (Pilling Weck, Research Triangle Park, NC)

All of these devices can be assembled and contained in a relatively compact, easily transported cart or container. At our hospital, we have both a difficult airway cart and a traveling intubation tackle box kept fully stocked at all times.

SECURING THE DIFFICULT AIRWAY THROUGH AN ORAL APPROACH WITH CONTROLLED VENTILATION

For those patients with CMT to the maxilla or any part of the head not involving the mandible, pharynx, or neck and for which the surgeon does not need intraoral access, the oral approach to securing the airway is usually chosen. For discussion purposes, the decision has been made that the patient has a stable cervical spine and it is safe to proceed with sedating the patient or inducing general anesthesia and using a muscle-paralyzing agent. Many anatomic features can make for a difficult oral intubation: the patient with an anterior larynx, a short neck, a small mouth opening, excess tissue, missing upper teeth, or any combination of the above provides a challenging scenario for any practitioner. Add the presence of blood, edema, gastric contents, or a parade of foreign objects to the picture and it will be a difficult airway to secure.

Several maneuvers may aid in improving the view of the airway anatomy. One maneuver commonly utilized to aid in visualization is cricoid pressure or "backward upwards return pressure" (BURP). These maneuvers involve using the thumb and forefinger (Fig. 1) aligned in such a way as to displace the larynx. The goal of this maneuver is to move the larynx into a position visible to the laryngoscopist. Many times improperly applied BURP can inhibit the view, not improve it. Invariably, the person applying BURP can only guess exactly which way and how hard to apply pressure. Proper technique requires the laryngoscopist to use his or her nonlaryngoscope hand to directly guide the fingers of the person applying BURP, moving the larynx to a more visible position, facilitating tracheal intubation. Sometimes even properly applied BURP distorts the view, requiring releasing of the pressure to reorient one's view.

If the direct laryngoscopy view reveals only the epiglottis, but not the larynx under it, often a standard ETT can be passed blindly under the epiglottis into the trachea. Attempting this maneuver with just an ETT usually leads to the ETT go posteriorly, blindly into the esophagus. Therefore, prior to a new attempt, we recommend using a rigid metal stylet. The role of the short rigid metal stylet practitioners insert into a regular ETT to aid oral intubation with direct laryngoscopy can be debated. Initially, many trainees tend to overuse rigid stylets because of the belief that it allows one to more easily direct the tip of the ETT into the glottis. Many practitioners bend/twist the stylet, attempting to facilitate ETT placement. Although the rigid stylet allows the practitioner to guide the ETT toward the glottis, it commonly inhibits the actual insertion of the ETT through the vocal cords. If the practitioner attempts to insert the ETT with the stylet in place, the bent ETT frequently will not pass through the vocal cords. The angle created by the bent stylet increases the dimensions of the ETT, impeding one's ability to place the ETT into the trachea. Ideally, with the stylet lubricated so it easily slides back and forth, the ETT can be pushed off the guiding stylet readily through the vocal cords. To do so smoothly, the practitioner forms the distal end of the stylet with a slight bend and the proximal end with a 90-degree bend, manipulating the ETT from the proximal end (not the middle). When the distal tip of the ETT is placed between the vocal cords, the practitioner catches the 90-degree bend with the index finger, using the thumb to advance the ETT off the stylet into the trachea. Another technique requires a second person to hold the stylet while the laryngoscopist advances the ETT forward off the stylet into the trachea. This maneuver can be beneficial when the epiglottis but not the larynx or vocal cords are visible on direct laryngoscopy. Forming the lubricated rigid stylet into a "hockey stick" shape at the distal end allows the practitioner to pick up the epiglottis with the ETT and subsequently slide the ETT off the stylet, as described above, under the epiglottis anteriorly into the unseen larynx. This blind technique utilizing a lubricated hockey stick–shaped stylet has wide application in securing difficult airways, with or without CMT.

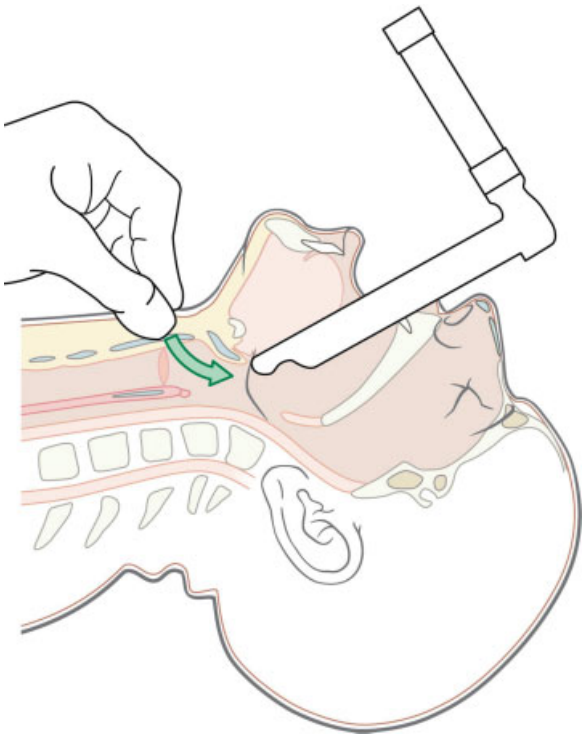

Figure 1 Using thumb and forefinger to displace the larynx.

Another maneuver entails manipulating the patient's lips to improve placing the ETT. Commonly, the laryngoscopist visualizes the laryngeal structures but, due to oral, mandibular, or pharyngeal anatomy, is unable to direct the ETT toward the vocal cords. When faced with this particular scenario, I instruct my assistant to hook the corner of the mouth with his or her index finger, pulling it toward the angle of the mandible (Fig. 2). Pulling the corner of the mouth in this fashion permits the laryngoscopist to change the angle of approach, facilitating in the placement of the ETT. Occasionally, even this tactic fails and I utilize the Portex tracheal tube guide (PTTG). The PTTG can be prepared (bending or twisting) into the desired shape to place at the laryngeal opening and advanced into the trachea. Once the PTTG is in place, a lubricated ETT is then passed over the PTTG. The placing of the ETT over the PTTG at this stage requires some advanced planning. The practitioner must choose an ETT with an internal diameter very close to the outer diameter of the PTTG. For adults, we use the No. 15 PTTG and choose a No. 7.0 ETT to place over the PTTG. As a point of caution: when one attempts to place an ETT over the PTTG, the bevel of the ETT must be angled posteriorly such that the

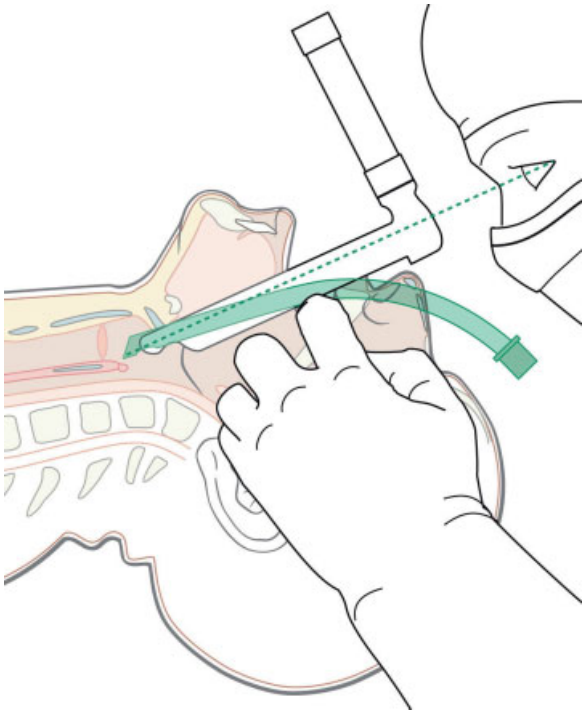

Figure 2 Hooking the corner of the mouth to improve the angle of approach for the endotracheal tube.

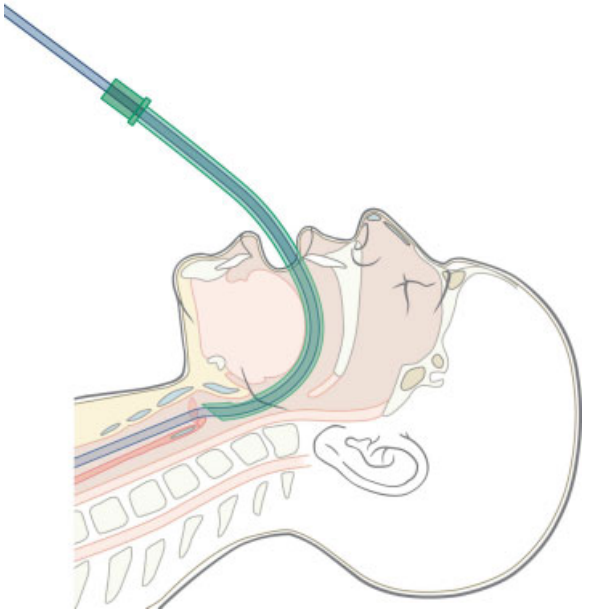

Figure 4 Bevel of endotracheal tube properly oriented, permitting easier passage into trachea.

leading edge slides over the anterior side of the PTTG (Figs. 3 and 4). Failure to place the ETT in this fashion may result in the bevel catching or hanging up at the aretynoid cartilage, making it nearly impossible to properly place the ETT into the trachea.

Occasionally, a patient with maxillary trauma has lost some teeth. If these teeth happen to be the top incisors or canines, a unique problem may occur. When one attempts to orally intubate this patient, the laryngoscope blade can relocate into the space previously occupied by the missing teeth. The trapped blade becomes difficult to adjust, and the mouth opening is reduced. Properly placing the ETT under these circumstances becomes difficult at best. Our solution for this problem utilizes the Pilling Weck Teeth Guard. By placing the teeth guard over the remaining upper teeth, the laryngoscope blade cannot become trapped, allowing more flexibility in adjusting the exact position of the laryngoscope blade as well as the ETT.

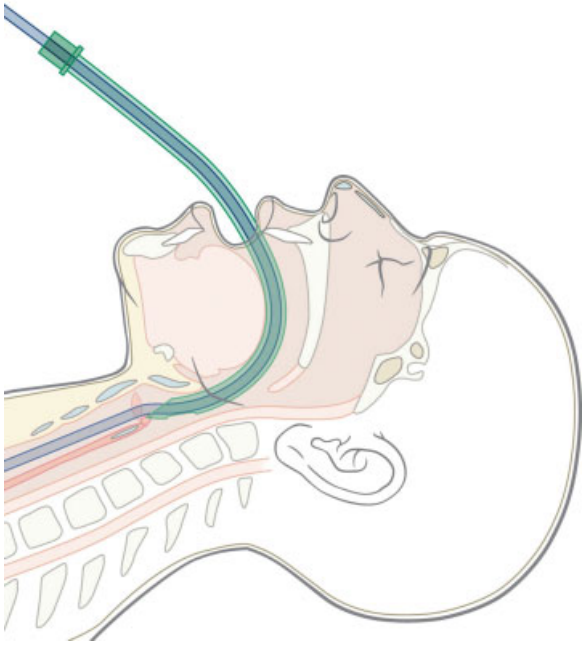

Figure 3 Bevel of endotracheal tube improperly oriented, allowing it to catch on the aretynoid cartilage.

When all of these techniques have failed, the practitioner needs to implement another method to secure the airway. The favored technique at our institution secures the airway using an LMA to guide a FOB. This technique utilizes the following devices; an appropriately sized LMA, a pediatric FOB, the correct uncuffed ETT, the proper PTTG, and the proper cuffed ETT. (See Table 1 for the specific sizes we use for our patients.)

For ease of presentation, I describe the technique using the devices appropriate for a 70-kg patient. Initially, a No. 4 LMA is placed. Care must be taken when placing any LMA, as improper placement can result in airway obstruction. As an aside, note that LMAs can be successfully placed in spontaneously ventilating, not fully cooperative patients. Place an oral airway to one side to prevent the patient from biting on the LMA. After the LMA is placed and the patient has a functioning airway, the practitioner assembles the following. An uncuffed

Table 1 Sizes of LMA, ETT, and FOB Used for Intubating Different Patients

Patient	LMA Size	FOB Type	ETT Size/Type
Large child (~6 y and older)	No. 2½ to No. 3, depending on size of patient	Pediatric FOB	No. 5.0 uncuffed
Teenager/small adult	No. 3	Pediatric FOB	No. 5.5 uncuffed
Normal adult	No. 4	Pediatric FOB	No. 6.0 uncuffed
Large adult	No. 5	Pediatric/adult FOB	No. 7.0 uncuffed

LMA, laryngeal mask airway; ETT, endotracheal tube; FOB, fiber-optic bronchoscope.

No. 6.0 ETT with the adapter firmly pushed in (firmly securing the 15-mm adapter to the ETT is critical to the success of this procedure; we corkscrew the adapter into the ETT as far as it will go) is placed over the pediatric FOB. A No. 15 PTTG and a cuffed No. 7.0 ETT are immediately available. To improve the view, we attach an oxygen source to the suction port of the pediatric FOB (this arrangement also provides oxygen to the patient) setting the flow at 2 L per minute. This flow rate helps keep debris from obscuring the view while not distorting tissues. The pediatric FOB is placed into the LMA and passed through the center of the grill at the opening of the LMA. Locate the glottis and place the FOB into the trachea. The LMA provides a conduit to the laryngeal structures while properly orienting the FOB for passage into the trachea. In our experience, even with distorted anatomy and nothing looking normal, if there is an airway with the LMA, one can find the opening for air passing into the trachea. Once in the trachea, one can verify proper location by visually confirming tracheal rings or the carina. When tracheal placement is confirmed, advance the No. 6.0 ETT over the FOB until the adapter meets the LMA (this placement is why we firmly push the adapter into the ETT). Depending on the patient, the No. 6.0 ETT is ~3 to 5 cm past the vocal cords. After removing the FOB, place the calibrated end of the PTTG into the No. 6.0 ETT. Advance the PTTG until the tip is ~27 to 28 cm into the trachea as measured from the teeth or the gum line. One has to carefully observe the calibration marks through the wall of the LMA. Once the PTTG is in place, carefully remove the LMA and the No. 6.0 ETT, taking extreme caution to leave the PTTG at the prescribed depth of 27 to 28 cm from the teeth or gum line. As one removes the LMA–No. 6.0 ETT combination out of the mouth, reach into the mouth and grasp the PTTG firmly. Remove the LMA–No. 6.0 ETT combination off of the PTTG. The PTTG is in the trachea; pass a No. 7.0 ETT as described above. See Figs. 5 through 8 for illustrations. Ventilate the patient and confirm with an end-tidal carbon dioxide monitor. Even in the worst conditions, when we rigidly follow this

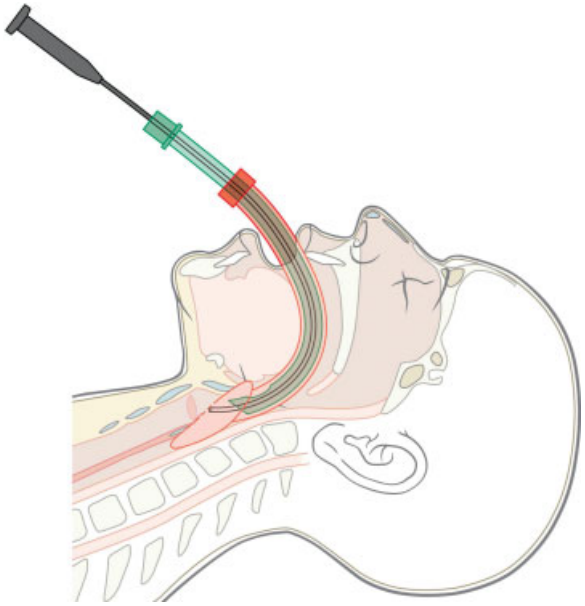

Figure 5 Pediatric fiber-optic bronchoscope loaded with No. 6.0 uncuffed endotracheal tube advanced through properly placed laryngeal mask airway.

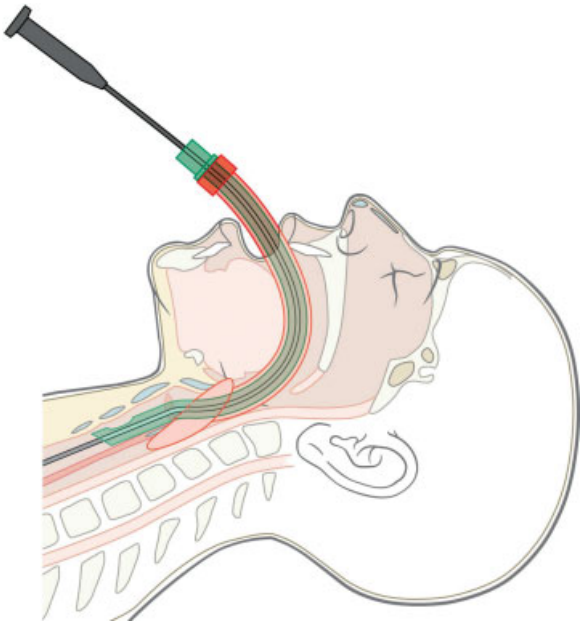

Figure 6 Pediatric fiber-optic bronchoscope passed through vocal cords into trachea. No. 6.0 uncuffed endotracheal tube threaded over pediatric fiber-optic bronchoscope into trachea.

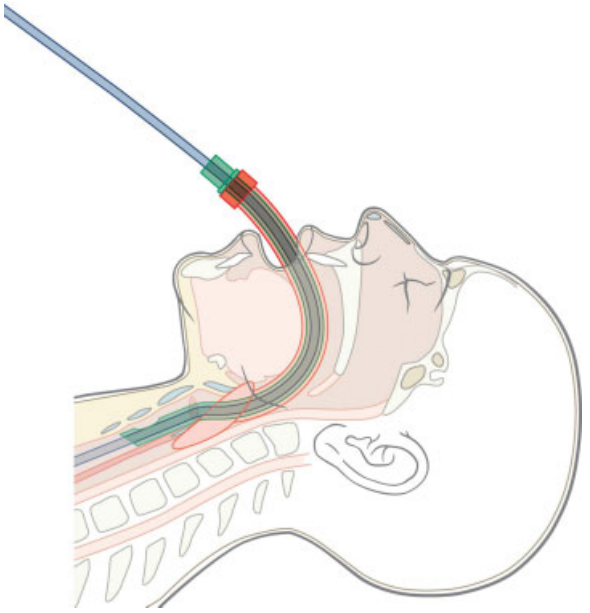

Figure 7 Pediatric fiber-optic bronchoscope removed. No. 15 Portex tracheal tube guide (PTTG) advanced through No. 6.0 uncuffed endotracheal tube into trachea. PTTG is advanced until it is 27 to 28 cm at the teeth/gum line.

protocol, we are able to secure the airway on our problematic patients.

Occasionally, we face an extremely large/tall patient with CMT. Frequently, the No. 6.0 uncuffed ETT is not long enough to pass through the LMA distal to the vocal cords. Under these circumstances, we utilize a No. 5 LMA, an adult FOB, and a No. 7.0 ETT with the cuff, pilot tube, and adapter (save the adapter) removed, and we cut a different No. 7.0 ETT to 15 cm to act as a spacer to hold the uncuffed No. 7.0 ETT in place. Following the technique described above, when the FOB is placed through the vocal cords into the trachea, instead of

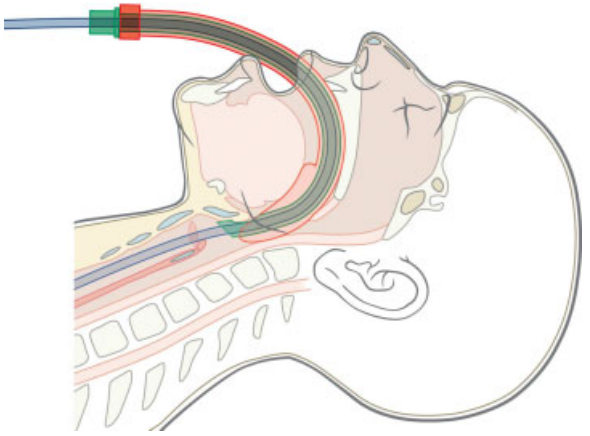

Figure 8 Remove laryngeal mask airway and uncuffed No. 6 endotracheal tube while securing No. 15 Portex tracheal tube (PTTG) guide at 27 to 28 cm at teeth/gum line. Place No. 7.0 endotracheal tube over No. 15 PTTG as described in Fig. 4.

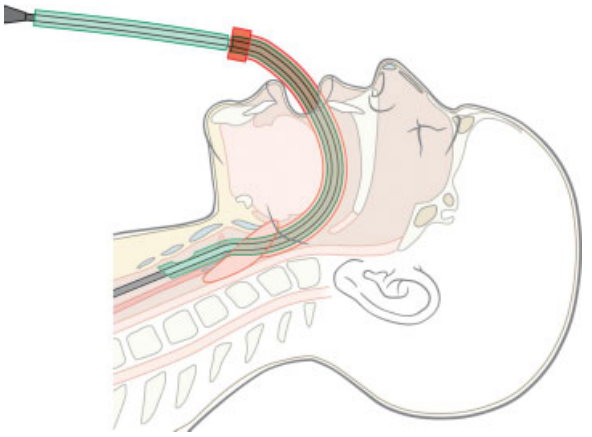

Figure 9 Adult fiber-optic bronchoscope loaded with No. 7.0 uncuffed endotracheal tube and 15-cm spacer through No. 5 laryngeal mask airway placed into trachea.

removing the FOB and placing the PTTG, remove just the LMA over the uncuffed No. 7.0 ETT and the FOB while an assistant grasps the spacer, holding the No. 7.0 uncuffed ETT in place and preventing it from coming out as the LMA is removed. Essentially, the uncuffed No. 7.0 ETT slides through the No. 5 LMA while withdrawing the No. 5 LMA over the spacer and the FOB. When the LMA has been removed from the oropharynx, firmly grasp the full-length uncuffed No. 7.0 ETT, reconfirm tracheal placement with the FOB, remove the FOB, place the saved adapter onto the ETT, and ventilate as needed. Use the Cook Airway Exchange Catheter size No. 19-French to exchange for the appropriately sized ETT (Figs. 9 and 10).

When the patient has an unstable cervical spine, all of the above maneuvers are still available to the practitioner. Under these circumstances, we designate an individual to protect the cervical spine with strict in-line stabilization.

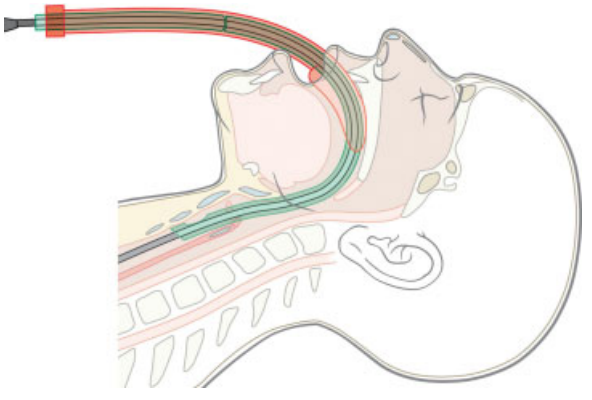

Figure 10 Remove No. 5 laryngeal mask airway over No. 7.0 uncuffed endotracheal tube, holding 15-cm spacer keeping uncuffed No. 7.0 endotracheal tube in place.

SECURING THE DIFFICULT AIRWAY THROUGH AN ORAL APPROACH WITH SPONTANEOUS VENTILATION

For patients with CMT who require an oral approach but are too unstable for sedation, techniques more suitable to the spontaneously ventilating patient are required. The variety of patients in this category will vary from a fully accommodating patient to the completely noncompliant one. Different levels of patient cooperation require the practitioner to adjust the technique to suit that specific patient. At our institution, the methods utilized for patients at either end of the spectrum differ dramatically.

For the patients at the cooperative end of the spectrum, the practitioner has a few options at his or her disposal. Even though the airway may be unstable, many patients follow commands completely, permitting the practitioner to anesthetize the airway and utilize a FOB. Under these circumstances, we seldom perform nerve blocks because CMT invariably distorts the anatomy, prohibiting reliable location of the correct nerves. Usually, our initial approach involves some form of topical anesthetic to anesthetize the intraoral structures and the posterior pharynx. These options range from an aerosolized topical lidocaine hydrochloride (usually 4%) through an inhaler, gauze soaked in lidocaine hydrochloride gel (usually 2%), or a variety of spray delivery systems. All of these methods work. Ultimately, practitioner preference combined with patient status determines which topical approach to use. Currently, we initially choose aerosolized topical 4% lidocaine hydrochloride through the Hudson RCI MICRO MIST nebulizer. Even a semicooperative patient can be persuaded to breathe through the mouthpiece of this inhaler. Care needs to be taken to ensure the patient inhales only through the mouthpiece. A loose mouth seal or nasal breathing reduces the effectiveness of aerosolized lidocaine hydrochloride. Assisting the patient with the mouth seal as well as limiting/obstructing nasal breathing helps produce an adequately anesthetized airway. In our experience, topically administered lidocaine hydrochloride reliably lasts around 20 to 30 minutes. Accordingly, we routinely prepare the patient in the operating room immediately and proceed to securing the airway.

The specific actions required to manipulate the FOB into the trachea to secure the airway are beyond this presentation. Nevertheless, the practitioner may benefit from a few suggestions. Try to pass the FOB through the glottis into the trachea during inspiration; the vocal cords tend to abduct at this time. If the view through the FOB fogs up from moisture, you are on the right track. A now-retired cardiothoracic surgeon once advised me to "follow the mist." To aid in the oral approach to placing the FOB, we place the Ovassapian airway as an oral airway. The Ovassapian airway has a channel large enough to accommodate an adult FOB as well as a No. 8.0 ETT while functioning as an oral airway, conveniently preventing the patient from biting. Also, we employ the following maneuvers as needed to assist the practitioner in placing the FOB properly: do not use the suction port of the FOB to suction out the oropharynx, prepare a separate suction source using a rigid suction device. Attach an oxygen source at 2 L/min flow to the suction port of the FOB (as described above). Several other tricks that may help include squirting topical xylocaine down the suction port of the FOB to help anesthetize the airway as well as clear the view through the FOB, having an implement available to pull the tongue anteriorly (we use a McGill forceps), and having an extra pair of hands to manipulate the airway (usually a jaw thrust, if possible, with CMT).

Commonly, the compliant patient with an anesthetized oropharynx tolerates the placement of an LMA. If the practitioner can place an LMA, then using a FOB to secure the airway as previously described frequently works.

Unfortunately, no foolproof solution exists for reliably securing the airway in an uncooperative or confused unstable patient. The practitioner needs to assess each patient individually, deciding on the approach after taking into account all factors influencing the clinical scenario. One aspect of the uncooperative patient that all practitioners must keep foremost in their minds relates to source of the confusion. In many patients, their confusion stems from their inadequate ventilation status. Patients with CMT may display adequate hemoglobin saturation on the pulse oximeter while being hypercarbic from hypoventilation. In this situation, the practitioner likely has less time than originally anticipated to secure the airway. A hypoventilation/hypercarbic state will rapidly lead to further hypoventilation secondary to the respiratory depressant effects of severe hypercarbia. This patient quickly becomes apneic, creating an airway emergency.

When the source of the patient's combative state results from their CMT or the presence of excess mind-altering drugs, then the practitioner must exercise clinical judgment to determine how best to proceed. We have employed techniques ranging from forcibly keeping the mouth open using an oral airway between the molars to bringing the patient into the operating room and sedating him or her there, with surgeons prepared to perform an immediate cricothyrotomy.

SECURING THE AIRWAY USING A NASAL APPROACH WITH CONTROLLED VENTILATION IN PATIENTS AMENABLE FOR SEDATION

For the patient with CMT to maxilla, mandible, or any injury for which the surgeon prefers intraoral access, many practitioners choose a nasally placed ETT. This section addresses those patients with a stable cervical

spine in which the practitioner deems it safe to sedate and use a muscle-paralyzing agent. Many times the surgeon has a preference regarding in which nostril (left or right) to place the ETT. When no preference exists, we ask the patient to forcibly exhale through one nostril at a time to help us decide which nasal passage to start with. After the patient has been sedated/anesthetized, we normally prepare the nasal mucosa with a mixture of oxymetazoline and 2% lidocaine hydrochloride gel. We mix these preparations into a slurry and use cotton swab applicators to liberally spread the slurry to the nasal mucosa of both nostrils. We tend to avoid topical phenylephrine because there are reports of hypertension and other side effects.[5] After nasal preparation, we insert a nasal airway lubricated with lidocaine gel to dilate the nasal passage. Then we pass the ETT of choice through the nasal passage into the posterior pharynx. Occasionally, the practitioner passing the ETT meets resistance before the distal tip enters the posterior pharynx. During the initial passage through the nose, the nasal turbinates may cause difficulty in passing the ETT. Usually this difficulty can be overcome by twisting the ETT to change the angle of the bevel. Sometimes we switch to the other nostril when passage proves to be impossible. Once past the turbinates, another difficulty may appear. The ETT may meet resistance before the ETT enters the posterior pharynx. This resistance likely results from the tip of the ETT catching on the mucosa over the body of the second cervical vertebra. The practitioner must take care to avoid excess force in this situation; the ETT may dissect under the mucosa in the posterior pharynx. Several maneuvers will aid the practitioner at this time. Withdrawing the ETT and twisting while slowly advancing usually works; however, we have resorted to using the FOB to steer around this obstruction as well as inserting a finger to manually redirect the ETT. Once the ETT freely advances and withdraws, staying beyond these obstructions while the distal tip remains in the posterior pharynx, the practitioner can progress toward inserting the ETT into the trachea.

One suggestion for practitioners: with the ETT in the posterior pharynx, use it as a functional nasal airway. Attach the breathing circuit (whether from the anesthesia machine or the Ambu bag) to the ETT, seal off the mouth and the other nostril, and ventilate the patient. The practitioner may need to adjust the ETT for optimal positioning for an adequate airway. This maneuver has rescued me many times when I could not ventilate some patients, including those with CMT. In my 25 years of clinical experience, the only time this maneuver did not work was on an 800-pound patient with clenched teeth and an immobile head from the extra tissue.

Next the practitioner inserts the laryngoscope to visualize the airway and pass the ETT between the vocal cords into the trachea. At this time, some anatomic issues commonly cause difficulties when passing the ETT into the trachea. Usually, this difficulty stems from the angle of approach of the ETT toward the vocal cords. Frequently, simply rotating the ETT orients it such that it passes easily. Depending on the patient's anatomy, the vocal cords may be easily visualized, yet the ETT does not easily pass into the trachea (Fig. 11). In this situation, the practitioner might benefit from using a McGill forceps to guide the ETT. Usually, bending the ETT forward toward the vocal cords works the best. Occasionally, we add the BURP maneuver to assist in placing the ETT. In a few instances, another practitioner would insert a FOB into the ETT and visually pass the FOB into the trachea while the original practitioner performs laryngoscopy. When these tactics fail, the practitioner may have to resort to securing the airway orally and deciding how to proceed after a dialogue with the surgeon.

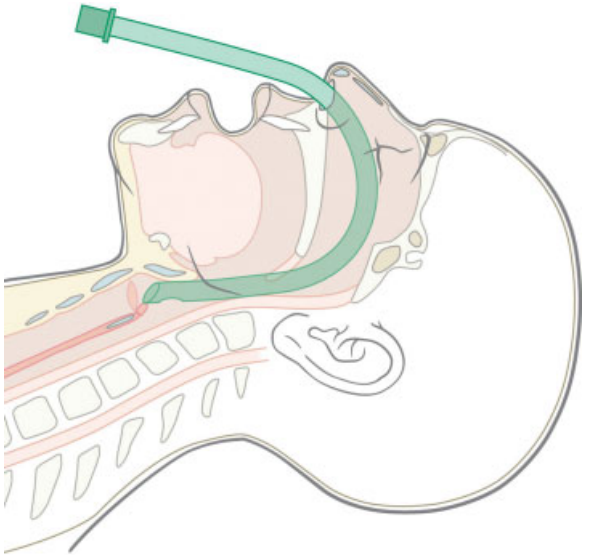

Figure 11 Nasally placed endotracheal tube approaches larynx at an acute angle, making advancement into trachea difficult.

Invariably, the practitioner will face circumstances that require immediate clinical judgment to secure the airway. With the ETT in the posterior pharynx attached to the breathing system, providing a method for ventilation, the practitioner has time to pursue other options. Possessing the ability to ventilate, the practitioner has time to analyze the situation and recruit additional equipment, personnel, or other resources. Often, an extra trained person, different equipment, or a change to the approach provides the necessary resources to overcome the obstacles present.

SECURING THE AIRWAY USING A NASAL APPROACH IN THE SPONTANEOUSLY VENTILATING PATIENT UNSUITABLE FOR SEDATION

The patient with CMT requiring a nasally placed ETT with an airway unsuitable for sedation compels the

practitioner to secure the airway with the patient spontaneously ventilating and awake. If the practitioner has time and access through the oral cavity, many of the methods described above will suffice. Clearly, the patient needs adequate topical anesthesia for any of those approaches to succeed.

Often, the patient's injury alters the anatomy, prohibiting any oral approach for securing the airway. Essentially, every time we face a patient requiring a nasal approach to secure the airway, our first choice revolves around maneuvers working exclusively through the nose using the FOB to aid in placing the ETT into the trachea. Initially, we apply topical anesthesia to the nasal mucosa as described above. This method can be employed even on the uncooperative patient. Once the nasal mucosa has been anesthetized, we gain access to the posterior pharynx as described above. At this point, if the patient is stable and does not need rapid securing of the airway, the practitioner has several alternatives to continue topically anesthetizing the patient. If the injury does not prohibit the patient from cooperating in using an oral approach to topically anesthetize the airway, then we employ the methods outlined above. If the injury prevents an oral approach using the previously mentioned tactics, then we choose one of the many aerosol spray anesthetics available and deliver the topical anesthetic nasally. Frequently, placing an ETT into the posterior pharynx improves the patient's ability to ventilate. The ETT provides an unobstructed conduit for air exchange. This conduit may be used to deliver the aerosolized spray. Regardless of whether we deliver the topical anesthetic orally or nasally, whenever possible we try to employ the following tactics when treating the patient with aerosolized topical anesthetic. The practitioner should try to coordinate the aerosol dosing with the patient's breathing pattern, using a device to focus the spray into the mouth or through the nasal passage. This method frequently requires a great deal of patience and many sprays for adequate topical anesthesia. We do not use a topical spray when we place an ETT through the nose into the posterior pharynx. When we use an ETT through the nose, we jury-rig the Hudson RCI MICRO MIST nebulizer inhaler onto the adapter of the ETT. This adaptation permits controlled delivery of the topical anesthetic. The practitioner then moves on to the actual intubation when the patient is adequately anesthetized. The specific maneuvers required to place the FOB and subsequently the ETT into the trachea are much the same as outlined above.

Another option available to the practitioner utilizes the FOB as the conduit for topical anesthesia delivery. If the practitioner feels time is a factor and depending on the clinical situation, he or she should consider injecting the topical anesthetic through the suction port of the FOB. Place 2 to 3 mL of 4% topical lidocaine hydrochloride into a 5-mL syringe, fill the remainder of the syringe with air, attach to the suction port, and empty the syringe liquid first, using the air in the syringe to force the topical anesthetic into the FOB while directly visualizing the airway anatomy. Using the FOB to visualize various aspects of the airway anatomy, the practitioner directs the spray accordingly. In our experience, two or three treatments suffice to adequately anesthetize the airway anatomy and facilitate tracheal placement.

Once the topical anesthetic has been administered, the practitioner should immediately proceed with securing the airway with the FOB. There are few differences between placing the FOB into the trachea of a spontaneously ventilating patient whether the nasal or oral approach is used. The tactics required to place the ETT are similar to those outlined above.

CONCLUSION

The vast majority of CMT patients fall into the categories outlined above. Frequently, it is relatively clear into which category a patient fits. When in doubt, err on the side of avoiding "burning bridges" by maintaining spontaneous ventilation if at all possible. Various approaches and techniques for securing the airway are available to the practitioner. Selecting which technique to apply requires the practitioner to analyze each individual scenario. The decision as to which approach to utilize should encompass the entire clinical situation while recognizing that both the urgency as well as the specific anatomic injury will greatly influence the technique chosen. The practitioner then implements the technique that he or she feels will provide the best opportunity for securing the airway.

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