# Difficult Airway

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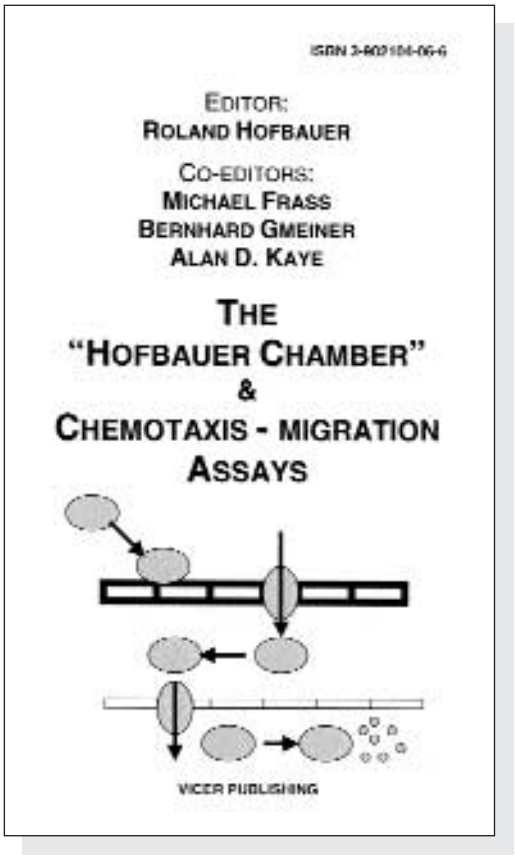


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Case report

# An unusual difficult airway scenario. A pharyngeal hematoma following thrombolytic therapy and attempted intubation.

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## ABSTRACT

**Objective:** Presentation of a patient suffering from a large hematoma following unsuccessful endotracheal intubation

**Case:** The patient's respiratory situation deteriorated after the development of a large hematoma. A well lubricated nasal airway was inserted through one of the patient's nostrils, while oxygen was administered via facial mask. The situation started to improve and a tracheotomy was performed.

**Conclusion:** We present an unusual presentation of a difficult airway scenario and a simple aid to the management of airway obstruction that helped solve the problem. Patients receiving thrombolytic therapy should be closely monitored, more so if they are subjected to any kind of airway intervention.

**Key Words:** Airway, cervical hematoma, thrombolytic therapy, nasal airway

## INTRODUCTION

The management of the difficult airway is a continuous challenge for the anesthesiologist. We report a case of a delayed and life threatening pharyngeal hematoma following thrombolytic therapy for the acute treatment of a myocardial infarction (MI), that was solved with a usually forgotten and simple aid, a nasal airway.

## CASE REPORT

A 70 yr-old male with known coronary artery disease (CAD) was admitted to the hospital with chest pain. A diagnosis of inferior wall MI was made

and he was transferred to the intensive care unit (ICU). As part of his initial treatment he received aspirin 100 mg orally and streptokinase 1.2 million units intravenously. At the end of the streptokinase treatment, the patient went into ventricular fibrillation, and was reversed with external defibrillation at 360 watts/sec. Following the electric shock, sinus rhythm was restored and the patient did not experience further cardiac arrhythmias during his hospitalization. As part of the CPR maneuvers, an unsuccessful attempt of endotracheal intubation was made (At latter questioning, the patient referred that he had a somewhat rigid neck due to cervical arthrosis.) Two hours after the event, the patient started to complain about throat soreness. He became dysphonic, with stridor and increased work of breathing. An ENT specialist was called for consultation and a fibro-laryngoscopy was performed that evidenced a large pharyngeal hematoma that extended from the left amygdaline pillar all the way along to the left vocal cord, which was displaced. A few hours later, the on-duty anesthesiologist was called to the ICU and found an extremely critical patient, sitting in bed and gasping for air. The was in the low sixties and the patient was agitated, diaphoretic, with his heart rate above 120 b/m and hypertensive. The decision was made to perform a tracheotomy. The patient was brought to the OR where he was unable to lie down. Desperately looking for a way to maintain an airway, the anesthesiologist eased a well lubricated nasal airway through one of the patient's nostrils, while administering oxygen via facial mask. The situation started to improve. The patient's breathing became less labored, the SaO2 went up progressively and he calmed down a bit. When the SaO2 reached the low nineties, the head of the surgical table was slowly brought down, while at the same time small doses of propofol, midazolam and fentanyl were given. Ventilation via facial mask was adequately maintained with appropriate oxygen saturation and capnometry, allowing the surgeons to perform a fast tracheotomy. The patient's recovery was uneventful .

## DISCUSSION

Although bleeding concomitant with thrombolytic therapy is a known complication (1) and there have been reports of both spontaneous (2,3) and traumatic (4,5) hematoma of the airway after treatment with streptokinase, we are unaware of a report of the complication presented by this patient. The breathing difficulties started about two hours after airway intervention and although the diagnosis of a pharyngeal hematoma was made, when the anesthesiologist was called to intervene the situation had deteriorated completely.

In an uncooperative patient with this type of pathology, any attempt to manipulate the airway could lead to a disastrous situation. Total obstruction of the glottic opening by the enlarged hematoma is not out of the question.

Besides that the clinical picture been worsened since the ENT diagnosis, the logistical situation did not permit the use of a fiberoptic bronchoscope (FOB) aided intubation. It was felt that various alternatives (Bullard laryngoscope, light wand, Combitube ', direct laryngoscopy) had a possibility of exacerbating the patient's problems, either increasing the size of the hematoma, collapsing the airway completely or rupturing it with catastrophic results.

To place a surgical airway, even under local anesthesia, the patient's conditions had to improve so he could allow the bed's head to be lowered. In this particular case, a simple but usually forgotten nasal airway allowed ventilation and permitted placement of a surgical airway. Although we are aware that the airway control was never fully achieved because multiple causes could have modified and worsened the situation, the insertion of the nasal airway was instrumental in solving the problem.

In summary, we present an unusual presentation of a difficult airway scenario and a simple aid to the management of airway obstruction that helped solve the problem. As recommended by others (5), the patients receiving thrombolytic therapy should be closely monitored, more so if they are subjected to any kind of airway intervention.

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Review

# Combitube: What is new?

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## ABSTRACT

**Background:** To describe the new aspects of a modern device for securing the airway and allowing oxygenation and ventilation especially in emergency situations.
**Data Collection:** Critical review of the literature
**Conclusion:** The Combitube has proven to be a valuable tool in elective surgery as well as in cardiopulmonary resuscitation. It has been included in the Guidelines of the American Society of Anesthesiologists, the American Heart Association, and of the European Resuscitation Council. Education tools using the combitube are described in this review. The Combitube has been shown to be a helpful and effective airway device in surgery as well as in cardiopulmonary resuscitation.

**Key Words:** Difficult airway, combitube, airway management, transesophageal intubation, cardiopulmonary resuscitation

## SIZES, RECOMMENDATIONS FOR INSERTION (ESPECIALLY IN ELECTIVE CASES), BALLOON AND CUFF VOLUMES

Two sizes of the Combitube (Tyco-Kendall, Mansfield, MA) are available: the Combitube SA 37 F and the Combitube 41 F. While the manufacturer recommends to use the Combitube SA 37 F in patients from 4 to 51/2 feet, and the Combitube 41 F in patients 5 feet and taller, recent studies (1-4) suggest to use the Combitube SA 37 F in patients from 4 to 6 feet, and the Combitube 41 F in patients 6 feet and taller. Therefore, the Combitube SA 37 F is the preferred size.

Insertion may be performed with or without the use of a laryngoscope: in case an endotracheal intubation has failed, the laryngoscope may be left in place and the Combitube inserted into the esophagus under direct visualization. The following points should be observed with blind insertion: the patient should be well anesthetized in

elective cases; the patient's head should be kept in a neutral or slightly elevated position, the chin maybe slightly lifted; holding the distal end of the Combitube bent for a few seconds ("Lipp maneuver") augments the curve and alleviates gliding of the Combitube around the tongue; the patient's mouth should be opened by grasping the back of the tongue and the jaw between thumb and forefinger and guiding the Combitube gently into the esophagus or trachea along the tongue in a curved downward motion with the distal end parallel to the chest (often it is tried to insert the Combitube directed against the neck so that the distal tip is caught at the posterior pharyngeal wall).

Another method of insertion is to pull back the upper jaw thereby increasing significantly the patient's mouth opening.

The volume to be inflated into the oropharyngeal balloon is 85 ml of air with the Combitube SA 37 F, and 100 ml with the Combitube 41 F. While these volumes should be inflated in an emergency (and even 50 ml additional air may be inflated in case of a leak), in elective cases volumes between 40 to 85 ml (using "minimal leakage technique") are sufficient to obtain a tight seal (3,4). Reduced volumes help to decrease the potential danger of mucosal injury.

The distal cuff is inflated with 5 to 12 ml of air with the Combitube SA 37 F, and with 5 to 15 ml with the Combitube 41 F. The maximum volumes of 12 and 15 ml, respectively, should never be exceeded to avoid potential harm to the esophagus (5).

## TEACHING

Several studies describe the easy way to place the Combitube after a short teaching instruction (6-9). The Combitube homepage (www.combitube.org or www.combitube.net) is helpful for rapid instruction of Combitube novices. Insertion times in mannequins can be considerably shortened by observing the following suggestions (10):

First, the Combitube and the mouth of the mannequin should be sprayed with silicone or a similar substance to avoid adhesion of plastic against plastic. The mouth of the mannequin should be opened with the thumb and index finger of one hand, the tongue grasped and pulled forward with the jaw and the Combitube passed gently into the patient's pharynx. The best mannequin head for the Combitube is produced by VBM (Medizintechnik, Sulz, Germany). Bending of the Combitube at the pharyngeal portion between the balloons for a few seconds enhances the preformed curvature (so-called "Lipp-maneuver") and makes placement even more rapid.

## TRAINING WITH THE COMBITUBE IN ELECTIVE CASES

To become familiar with the Combitube it is wise to use it five times in elective surgery in patients younger than 60 years (3,4). For elective cases, we recommend to use the laryngoscope and the minimal leakage tech-

nique. The reduced price (US $ 35 for the single kit) allows now for training.

## USE OF THE COMBITUBE AS A RESCUE DEVICE

Many difficult situations have been described and many more have been mastered without being published because of fear of potential legal problems, despite the fact that the Combitube worked excellent and made survival of patients possible when other means of managing the difficult airway had failed.

Excellent results have been found in studies evaluating the use of the Combitube in cardiopulmonary resuscitation. A prospective study in Canada revealed that the Combitube was rated best by the EMT's with respect to airway patency, adequacy of ventilation, and overall performance when compared to PTLA and laryngeal mask (11). The study was supported by the companies producing PTLA and LMA. In this study, some of the EMT's were trained with the laryngeal mask in the OR These findings are in accordance with a Japanese retrospective study, which showed that the Combitube was the most successful device with respect to insertion and adequate ventilation when compared to EGTA and laryngeal mask (12). The Combitube has been successfully used in trauma patients with traumatic brain injury, mandible and facial fractures (13), and cervical spine injury (14).

## SAFETY AGAINST ASPIRATION

There was no sign of gastric inflation as evaluated during surgery (3,4,15,16). The Combitube seals effectively with airway pressures as high as 50 cm H2O and higher. The Combitube is also the only alternate device used in the prehospital setting without danger of aspiration (11,12). Wissler recommends the Combitube as the first choice in parturients who cannot be mask-ventilated or endotracheally intubated (17).

## NO COMPLICATIONS, IF PRECAUTIONS ARE OBSERVED: ANESTHETIZE ACCORDING TO STATE-OF-THE-ART PROCEDURES

Inadequate use of the Combitube may be lead to serious injury (5,18): the patient should be well anesthetized (18), do not use force (18), and the maximum filling volume of the distal cuff (12 ml with the Combitube SA 37 F, and 15 ml with the Combitube 41 F) should not be exceeded (5). The use of a laryngoscope is recommended whenever feasible.

## TRAINING, INCLUSION IN GUIDELINES

Data suggest that training is very short and shows the effectivity of the Combitube (19). The Combitube is the only alternate airway device to be in-

cluded in the Guidelines of the American Heart Association since 1992 and has been recently upgraded to a class IIa device (20). It is furthermore recommended as a non-invasive alternative for the management of the difficult airway by he American Society of Anesthesiologists (21), and by the European Resuscitation Council (22).

## FUTURE ASPECTS

Future developments include a pediatric size Combitube to be used in pediatric patients with a height of 3 to 4 feet, furthermore the inclusion of a "bronchoscopic hole" for fiberoptic replacement of the Combitube (23). Publications dealing with sterilizing the Combitube for repeated use are underway.

## AVAILABILITY, CHEAP PRICE

The Combitube is available in a rigid tray, in a roll-up kit, as well as in a single kit with a resealable pouch, the roll-up-kit and the single kit being considerably cheaper than the rigid tray. Furthermore, a "Combitrainer" (size 41 F only) with double thick cuffs for the use in mannequins is produced.

## CONCLUSIONS

The Combitube is the ideal rescue device including all advantages needed in extreme situations in one simple airway: Quick insertion time, adequate airway patency (11), simultaneous fixation, sufficient ventilation and oxygenation, prevention of aspiration, and applicability of high ventilatory pressures make it a device to be considered as the first non-invasive alternate airway whenever endotracheal intubation is not immediately possible (24,25). The Combitube has been shown to be a helpful and effective airway device in surgery as well as in cardiopulmonary resuscitation. It has gained worldwide interest and has been used in emergency situations by anesthesiologists as well as be medical personnel. Indications for experienced anesthesiologists and intensivists include bleeding and vomiting patients, parturients who cannot be successfully intubated endotracheally, and emergency intubation in other non-fasting patients with respiratory failure.

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# New Thoughts on Airway Management in Trauma

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## ABSTRACT

**Background:** Airway management is one of the corner stones in airway management of traumatized patients. The purpose of this paper is describe new and old aspects of endotracheal intubation in these patients.

**Data collection:** Aspects of airway management in trauma are collected from literature and recent conferences.

**Conclusion:** Airway management of the trauma patient can be difficult and challenging. At present many techniques others than direct tracheal intubation are available with which emergency personnel must be familiar. Emergency airway management has progressed far beyond simple consideration of placement of an endotracheal tube and should now consist of a strategic approach that will result in successful airway management and optimal patient outcome, regardless of the patient's presenting circumstances.

**Key Words:** Difficult airway, endotracheal intubation, trauma, ventilation, laryngoscopy, fiberoptics

## INTRODUCTION

Airway management is one of the corner stones in the treatment of traumatized patients. The trauma patient usually presents a difficult and complex setting for airway management. This complexity arises from a variety of conditions that directly or indirectly influence on airway management (1). Most preventable trauma-related deaths are caused by failure to diagnose and treat basic problems with the airway, breathing, or circulation (the "ABCs").

Of paramount importance is oxygenation. Although patients may be breathing spontaneously on admission, supplemental oxygen is important to maintain physiology in stress conditions and to prevent rapid onset of hypoxia if ventilation worsens. Patients presenting with cardiac or respiratory arrest require immediate artificial ven-

tilation. Other patients with severe head trauma require endotracheal intubation for both airway and brain protection.

Patients who have suffered major trauma can present the most complex airway management problems, especially in the prehospital setting (2).

Airway management involves far more than just proficiency with tracheal intubation techniques. Clearly, several techniques are available (3), and the method chosen depends on the availability of equipment, the level of training and expertise, and the patient's specific injury.

Of utmost importance, the attendant physicians must be able to recognize patients in whom airway management may be difficult to hand and be able to formulate and implement alternative plans in various situations.

There are now a great number of pharmacological agents, techniques, and devices available for skilled clinician (4). Endotracheal intubation is the gold standard for airway management in trauma patients. This article reviews the different approaches to endotracheal intubation and devices available, including rescue maneuvers that may be undertaken when intubation fails.

## ASSESSMENT

Almost by definition, the trauma patient represents a difficult airway. Therefore, these patients should be carefully and continuously evaluated to ensure that the approach to the airway is appropriate. A back-up plan should be in place in the event that the primary approach to the airway is unsuccessful (5). Several attributes have been identified that predict increased difficulty in intubation. For example, the patients with facial injury who are immobilized on a long spine board with a cervical collar in place and who are combative present both anatomic and cognitive barriers to effective airway management.

## PLANNING AN APPROACH

As airway management in trauma can constitute an emergency, the team should be also prepared with a complete armamentarium, which not only include a variety of devices but also an algorithm to solve any situation that might arise, including the "cannot intubate-cannot ventilate" situation. Oxygenation and ventilation must remain adequate all over the evaluation and management.

## OPENING THE AIRWAYS

With loss of consciousness or induction of anesthesia, relaxation of the jaw and tongue occurs such that the base of the tongue and epiglottis obstruct the posterior pharynx. Therefore, the most important technique to open the airway is anterior displacement of the mandible, which elevates the epiglottis and base of the tongue from the posterior pharyngeal wall. This can be accomplished by lifting the mentum of the mandible with the fingers of one hand, the "chin-lift ma-

neuver". When more effort is required to relieve airway obstruction, the mandible can be pushed forward by the fingers of both hands behind the angles of the jaw, the "jaw thrust maneuver". This technique is contraindicated in patients with known or suspected cervical spine injuries.

We recommend the use of oropharyngeal or nasopharyngeal airway only to preoxygenate the patient before securing the airway, due to an increased risk of vomit and bronchial aspiration. Nasopharyngeal airways are contraindicated in patients suspected of having basilar skull fractures.

## CONSIDERATIONS IN TRAUMA PATIENTS

***Prehospital Endotracheal Intubation and Ventilation***

Prehospital intubation/ventilation attempts may be difficult or fail due to a variety of factors (6), mainly patient's position (sitting or lying on the ground), illumination conditions and limited resources available. Even experienced anesthetists may have difficulty in managing these patients. Each trauma center should design a strategy according to the local conditions and resources.

***Cervical Spine Immobilization***

Virtually all victims of blunt trauma are immobilized on a spine board with a cervical collar before being transported to the emergency department (7,8). Cervical spinal cord injury should always be suspected in all patients.

When intubating the blunt trauma patient, who is at risk of cervical spine injury, pay strict attention to immobilization of the head and neck throughout the procedure. This is best achieved by having an assistant maintain manual-in-axial traction (MIAT) (9) of the head and neck while intubation is performed. With properly MIAT, rapid sequence intubation (RSI) is considered safe in patients with potential cervical spine injury as well. Although it is permissible to open the cervical collar to facilitate jaw opening during intubation leaving the posterior semirigid portion to provide support, it is important to maintain strict immobilization. Laryngoscopy should be gentle and traction on the head and neck by the person performing immobilization or on the anterior neck by the intubator should be avoided.

***Maxillofacial Trauma***

Certain fractures of the facial skeleton have been associated with airway compromise. Bilateral condylar fractures with a symphyseal fracture or a bilateral body fracture of the mandible may cause loss of support of the glossal and suprahyoid musculature, thereby allowing the soft tissues to fall posteriorly, obstructing the oropharynx (10,11).

***Laryngeal Injuries***

Extreme caution must be used if intubation is performed because an exacerbation of the injury may occur. Therefore, blind intubation techniques are contraindicated. A surgical intuba-

tion technique must be strongly considered, especially if the laryngeal fracture is displaced. The first choice is awake fiberoptic endotracheal intubation. In the event of a coexistent tracheal injury, the endotracheal tube cuff must be distal to the site of injury to avoid barotrauma (10,12).

### *Anterior Neck Trauma*

Blunt trauma to the anterior neck may critically disrupt the continuity of the airway leading to a life-threatening situation. Anatomic airway disruption, with neck swelling due to hematoma formation and subcutaneous emphysema, and bleeding into the airway, demands immediate awake tracheal intubation. Fiberoptic intubation could be extremely difficult. Great vessels or pulmonary injury must be suspected (13,14).

### *Head Trauma*

The presence of serious head injury does not present a specific barrier to intubation, but requires the use of appropriate techniques to minimize the potential for elevation of intracranial pressure and secondary brain injury. Sympathoadrenal response to intubation can be blunted by prior administration of opioids (15). In addition, tracheal intubation is sometimes necessary for imaging studies of semiconscious, combative, or uncontrollable patients (16).

### *Thermal Injury*

Thermal injuries may affect airway management because of facial and perioral swelling, laryngeal edema, and impaired gas exchange by chemical injury to lung tissue. If the patient presents with apnea, a burned face, stridor, or hoarseness, the trachea should be intubated immediately (17).

## TECHNIQUES FOR TRACHEAL INTUBATION IN TRAUMA

### *Direct Endotracheal Intubation*

All trauma victims must be considered to have a full stomach and to be at high risk for vomiting, regurgitation, and aspiration. Thus, endotracheal intubation remains the gold standard for management of these patients. To minimize the risk for aspiration during the procedure in the presence of a full stomach, endotracheal intubation can be performed with the patient awake or with a RSI technique. The classic rapid sequence, or so-called "crash" induction technique with hypnotics, opioids, muscle paralysis and oral tracheal intubation is our choice in trauma situations in which adequate preoxygenation of the patient is feasible. We use an inductor agent (thiopental or etomidate), opioids (fentanyl) and high dose of muscle relaxants (vecuronium 0.3 mg/kg or rocuronium 1.2 mg/kg). Mask ventilation with cricoid pressure (the Sellick maneuver) is advisable to preoxygenate apneic patients, considering that near 30% of patients have already aspirated gastric contents before airway management. Thus, despite airway protection should be instituted immediately our main

concern is ventilation and oxygenation. After the patient loses consciousness, cricoid pressure is applied and maintained until the trachea is intubated and the cuff inflated. The importance of using a properly functioning suction apparatus must be overemphasized.

If esophageal intubation is accidentally performed, the cuff should not be deflated and the tube should not be removed but displaced to the left. A new laryngoscopy and tracheal intubation should be attempted.

If vomiting occurs before securing the airway, the cricoid pressure should be immediately released and the patient should be lateralized in block.

## ALTERNATIVE TECHNIQUES FOR ENDOTRACHEAL INTUBATION

Many techniques are available to facilitate airway management in trauma patients, remaining endotracheal intubation as the gold standard. All emergency physicians and rescue team members should be experienced with several of the available devices (18).

### *Awake Intubation*

Awake intubation techniques comprise principally blind nasotracheal intubation and awake oral intubation, although many of the other techniques could technically be considered "awake" intubation techniques (19). Nevertheless, awake oral intubation is preferable to blind nasotracheal intubation when there is evidence of anatomic disruption or compromise of the upper airway. An alternative approach is to use awake laryngoscopy to determine whether intubation will be possible. In this method, intravenous sedation and topical anesthetic agents are administered to permit oral laryngoscopy. If oral laryngoscopy demonstrates that intubation will be successful, then standard rapid sequence intubation can be undertaken safely.

### *Nasotracheal Intubation*

It is usually the technique of choice for stable, less emergent patients with mandibular fractures or immobility of the jaw either from trismus or mechanical impairment of the temporomandibular joint. Nasotracheal intubation can be performed either blindly or over a fiberoptic bronchoscope in awake or anesthetized patients. It is contraindicated for patients with a basilar skull fracture.

### *Fiberoptic Intubation*

This is the preferred alternative technique for tracheal intubation in trauma. It is usually performed as an "awake" technique, with the patient sedated and topically anesthetized. Fiberoptic intubation is a well-defined part of the armamentarium for management of the difficult airway in anesthesiology practice and its popularity is increasing in emergency medicine as well. Limitations of fiberoptic intubation include difficulty in handling secretions or blood with limited suction, operator inexperience, and the degree of patient cooperation that is required.

***Fiberoptic Intubating Laryngoscopes***

Fiberoptic modifications of the laryngoscope not only improve the view of the larynx, especially in patients with difficult anatomy, but also permit tracheal intubation with less head and cervical spine extension than are required for conventional laryngoscopy. Recently introduced special laryngoscopes, such as the Bullard laryngoscope, Upsher-Scope or the Wu-Scope may provide similar advantages. Success with these devices, however, requires considerable experience. These devices are designed to facilitate orotracheal intubation with the patient's head in the neutral position and without movement of the patient's head or neck.

***Illuminating Stylet (Lightwand)***

A lighted stylet, or lightwand, is a malleable stylet with a light bulb at the leading end and a battery in the handle. The principle of the technique is to pass the tube directly through the glottis and into the trachea using the maximal transillumination to confirm position of the tube. The surrounding lights have to be dimmed, the patient's tongue is grasped with a gauze sponge and gently pulled forward, and the endotracheal tube containing the lighted stylet is inserted into the oropharynx and advanced. When the tip is correctly positioned in the midline just superior to the larynx, a glow is evident in the anterior neck. The tube is slid off the lightwand and advanced into the trachea. Blood or foreign bodies near the glottis or obesity diminishes the viability of the transillumination technique because of poor visibility of the signature glow, particularly in bright sunlight.

***Retrograde Intubation***

A flexible guidewire is passed in retrograde fashion through a needle that has punctured the cricothyroid membrane (20). The guidewire is retrieved through the mouth and inserted into the distal end of an endotracheal tube through the Murphy's eye. The endotracheal tube is then advanced in antegrade fashion until it makes contact with the cricothyroid membrane. With the tube carefully immobilized in this position, the guidewire is then cut at the skin and pulled out through the endotracheal tube via the patient's mouth. The endotracheal tube is then passed further down into the trachea. Although the technique may sound relatively straightforward, it can be very difficult, especially in a conscious patient.

## THE FAILED INTUBATION

Persistence in futile attempts at intubation may severely compromise the patient by causing persistent or profound hypoxemia and ultimately neurologic injury. It is recommended to make no more than 3 trials, including a "best intubation attempt".

Failed intubation not always means failed ventilation, but potential compromise of oxygenation and bronchial aspiration of gastric contents should be

considered. This situation should be distinguished from the "cannot intubate-cannot ventilate", in which there is no more time and insertion of a ventilation device (Combitube or Laryngeal Mask Airway) must be performed immediately. It should be also noted that it does not necessarily imply a surgical airway, but consideration of alternative techniques such as fiberoptic intubation.

The final and definitive rescue from the failed airway is cricothyrotomy (21). Although cricothyrotomy requires skill and training, it provides definitive airway management and should be undertaken immediately when ventilation and oxygenation of the patient are not possible by other means. Percutaneous transtracheal ventilation is an emergency procedure that involves the insertion of a large (14-gauge) catheter or one of the available kits (MiniTrach, QuickTrach) through the cricothyroid membrane to permit ventilation. There are several important considerations regarding the oxygen source for percutaneous transtracheal ventilation and variations in the technique for patients of various ages, and the reader is referred elsewhere to review these important principles.

## CONCLUSIONS

Airway management of the trauma patient can be difficult and challenging. At present many techniques others than direct tracheal intubation are available with which emergency personnel must be familiar. Emergency airway management has progressed far beyond simple consideration of placement of an endotracheal tube and should now consist of a strategic approach that will result in successful airway management and optimal patient outcome, regardless of the patient's presenting circumstances.

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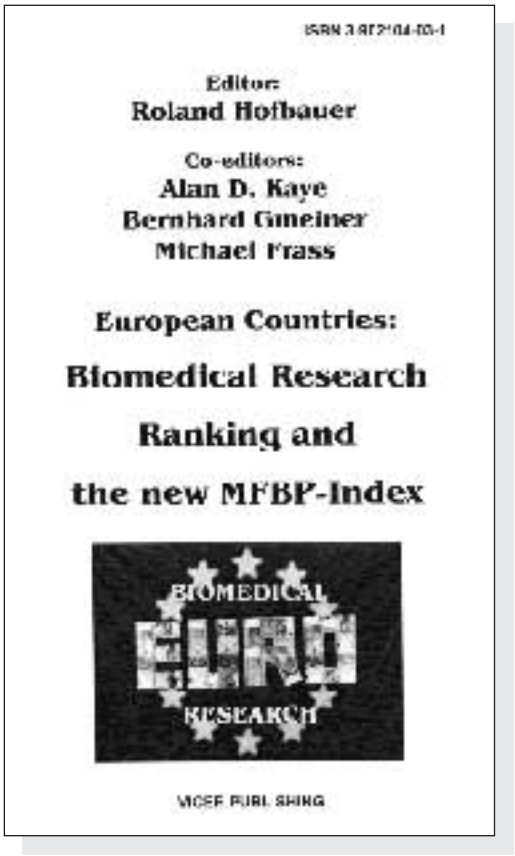


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