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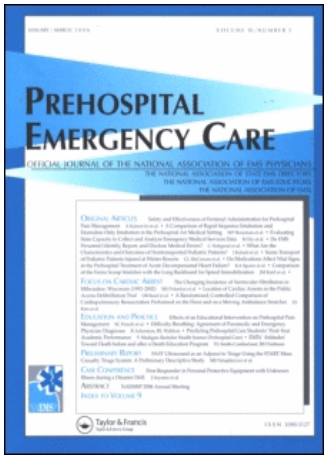

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An Algorithmic Approach to Prehospital Airway Management

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CONCEPT PAPER

AN ALGORITHMIC APPROACH TO PREHOSPITAL AIRWAY MANAGEMENT

Henry E. Wang, MD, MPH, Douglas F. Kupas, MD, EMT-P, Mark J. Greenwood, DO, JD, Mark E. Pinchalk, BS, EMT-P, Terry Mullins, MBA, William Gluckman, DO, EMT-P, Thomas A. Sweeney, MD, David Hostler, PhD

ABSTRACT

Airway management, including endotracheal intubation, is considered one of the most important aspects of prehospital medical care. This concept paper proposes a systematic algorithm for performing prehospital airway management. The algorithm may be valuable as a tool for ensuring patient safety and reducing errors as well as for training rescuers in airway management.

Key words: airway management; endotracheal intubation; algorithm; safety; training.

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Airway management, including endotracheal intubation (ETI), is considered one of the most important procedures in prehospital medical care. Airway management is a uniquely complex process that requires the integration of a sequence of tasks. While systematic guidelines for airway evaluation and management have been proposed by other medical specialties for the in-hospital setting (for example, the operating room and the emergency department), similar guidelines have not been proposed for airway management in the prehospital setting.[1–5]

This concept paper proposes the Prehospital Airway Management Algorithm (Figure 1). The purpose of the algorithm is to outline the critical elements that comprise the process of prehospital airway management and ETI. By specifying and sequencing the important steps of airway management, the algorithm may provide a tool for ensuring patient safety and reducing errors. In addition, this framework may be used to train prehospital students in the conceptual process of airway management.

OVERVIEW—A SINGLE AIRWAY MANAGEMENT ALGORITHM

Algorithms have been used to describe and simplify the execution of complex treatment strategies for life-threatening conditions such as cardiopulmonary arrest.[6] The Prehospital Airway Management Algorithm identifies, sequences, and integrates the multiple critical elements of prehospital airway management. The algorithm emphasizes the iterative nature of airway management and highlights the role of airway procedures as elements of a larger airway management process.

A distinct feature of this algorithm is the use of a *single* decision pathway for the management of all prehospital airways. While several national training courses have popularized the use of different airway management pathways in the in-hospital setting (for example, the use of "non-emergent" and "crash airway" pathways), we believe that these strategies are best suited for the stable in-hospital setting where additional personnel and clinical resources are readily available.[3] Compared with the in-hospital setting, airway management in the prehospital setting is arguably more challenging, and the introduction of multiple algorithms would bring additional confusion to this already complex process.

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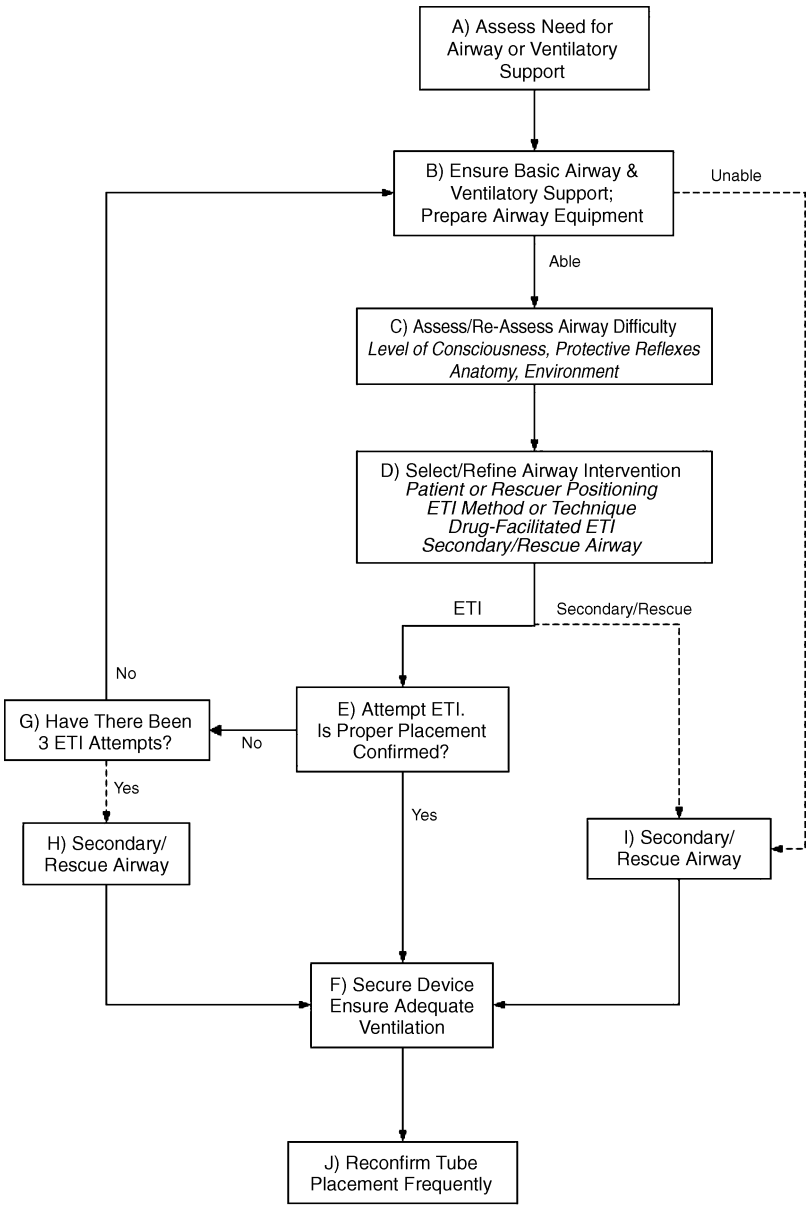

FIGURE 1. The Prehospital Airway Management Algorithm. ETI = endotracheal intubation.

An important aim of the algorithm is to facilitate rapid progression through airway management options. In practice, it is unlikely that rescuers will identify every possible difficult airway trait or corrective technique. If selected strategies are not effective, rescuers should make reasonable choices and progress quickly to the next steps. Rescuers should avoid "tunnel vision," for example, focusing on repetitive, prolonged, and often ultimately futile ETI intubation efforts, and losing sight of the need to move forward with rescue airway placement.

Another important theme of the algorithm is the application of low thresholds for using a secondary or rescue airway (for example, a Combitube). Each of three separate pathways leads to secondary/rescue airway placement: 1) when basic-level airway support and ventilation cannot be established (Section B); 2) when the rescuer determines that ETI methods are or will likely be futile (Section D); and 3) when the rescuer has made three unsuccessful ETI attempts (Section G). These thresholds discourage repetitive, futile ETI attempts when other reasonable airway management alternatives are available.

While the algorithm identifies the value of rapid and successful ETI, certain services may elect non-ETI methods as the primary techniques for managing the airway. There may also be clinical scenarios in which ETI is not the first-line option (for example, a hypoventilating victim of a narcotic overdose who is treated with intravenous naloxone, or a patient who is entrapped).

The algorithm is a concept based on the best scientific data currently available; we have highlighted gaps in evidence that merit future study.

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Alterations in the algorithm are expected as additional scientific evidence emerges. While individual services may customize the algorithm to conform to local protocols, we discourage adding multiple "branches" to the algorithm, as doing so will obscure the algorithm's overarching conceptual framework. It is important to note that this conceptual framework was designed primarily for adult prehospital patients; modification may be necessary for application to pediatric patients.

A TOOL FOR REDUCING AIRWAY MANAGEMENT PROCESS ERRORS

Perhaps the most important aspect of the algorithm is its potential for ensuring patient safety and reducing errors during airway management. As defined by the patient safety literature, prehospital airway management has many characteristics of a complex process.[7] Airway management is a difficult task requiring the successive execution of multiple critical decisions and tasks. The process is not linear, as the rescuer must continuously react and adjust to feedback and changes in clinical and other conditions. Also, the process is tightly coupled, as small errors at critical decision/action points may quickly magnify to result in airway compromise and patient death. Examples of potential airway management process errors are listed in Table 1. By outlining and sequencing key tasks and decision points, the systematic approach prescribed by the algorithm may reduce the risk of these process errors.

Structured algorithms have been used in nonmedical settings to prevent process errors. For example, in the aviation industry, checklists are routinely used to ensure safety during the performance of both routine and emergent tasks.[7] This algorithm may provide a tool for leading rescuers systematically through important tasks and difficult decision points during the stressful experience of resuscitation and airway management.

TABLE 1. Examples of Airway Management Process Errors

Failure to recognize the need for airway support
Failure to preoxygenate prior to ETI attempts
Failure to properly prepare equipment for ETI effort
Failure to recognize difficult airway traits
Improper selection of airway techniques or interventions
Prolonged or repeated laryngoscopy
Failure to confirm ET tube placement
Failure to recognize ET tube misplacement
Failure to recognize ET tube dislodgment
Failure to promptly proceed to use of rescue airway

ETI = endotracheal intubation; ET = endotracheal.

Although not primarily designed for this purpose, the algorithm could be incorporated into an airway management checklist that is consulted by a team member during the effort. In-hospital trauma resuscitations and cardiac arrests are typically run by a team leader. Prehospital rescuers may find that airway management is best accomplished when the efforts are similarly observed and directed by a team leader whose actions are guided by the algorithm, even if there are only two rescuers on the crew.

QUALITY ASSURANCE AND DOCUMENTATION

The proposed algorithm is conceptual only, and its effectiveness must be evaluated in both controlled (i.e., human simulation) and clinical situations. Efforts to evaluate the clinical application of the algorithm should adhere to those airway data element standards and definitions previously recommended by the National Association of EMS Physicians (NAEMSP).[8] We emphasize that, in conformance with these standards, an intubation attempt in the algorithm is defined as the insertion of the laryngoscope blade (not the endotracheal tube) into the mouth.[8]

IMPLICATIONS FOR TRAINING

Currently, paramedic training emphasizes discrete airway management procedures and techniques.[9] Virtually no training is provided regarding the *process* of airway management; that is, how to assimilate and integrate airway assessment, management, and procedural skills in response to changing clinical conditions. The algorithm provides a context for teaching this important concept.

Naturally, this suggests that training in prehospital airway management might require revision from a skills-focused curriculum to one that is process- and outcomes-oriented. To this end, airway management training would need to incorporate the use of clinically realistic scenarios through the use of human simulation or other educational technology. The goals of such training would need to extend beyond simple intubation success or failure. Instead, students must acquire skills in situational awareness and critical, goal-directed thinking.

ELEMENTS OF THE ALGORITHM

Section A: Assess the Need for Airway or Ventilatory Support

The first step in airway management is recognition of the need for airway management. There are anecdotal reports that rescuers of various levels are poor at recognizing the need for airway and ventilatory support.[10] While there are currently no evidence-based indications for invasive airway management or ventilatory support, general conditions and physical findings suggestive of the need for these measures are listed in Table 2.[8] In general, the need for airway management or ventilatory support should be identified using rapid "global assessment" techniques. Only rarely should detailed physical examination or formal

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TABLE 2. Factors Suggestive of the Need for Invasive Airway Management or Ventilatory Support and Essential Airway Equipment Preparation Tasks

Factors suggestive of need for invasive airway management/ventilatory support
General conditions
Apnea or agonal respirations
Airway reflexes compromised (ventilatory effort adequate, e.g., unconscious without a gag reflex)
Ventilatory effort compromised (airway reflexes adequate, e.g., pulmonary edema)
Injury or medical condition directly involving the airway
Adequate airway reflexes and ventilatory effort, but potential for future airway or ventilatory compromise due to course of illness, injury (head or other), or medical treatment.
Additional findings
Increased respiratory rate
Muscular retractions (suprasternal, intercostal, abdominal)
Labored breathing
Impaired speech
Decreased level of consciousness
Agitation
Pallor or cyanosis
Increasing end-tidal carbon dioxide.
Inadequate oxygen saturation.
Essential airway equipment preparation tasks
Prepare/activate oxygen cylinder and regulator
Prepare/pre-inflate bag–valve–mask device or non-rebreather mask
Prepare nasopharyngeal/oropharyngeal airway
Prepare/activate suction unit and catheters
Prepare and test laryngoscope blades
Prepare and test endotracheal tubes (including stylet and cuff syringe)
Attach patient to monitor and obtain vital signs
Select drugs; calculate and administer appropriate dosages
Prepare endotracheal tube confirmation devices
Prepare endotracheal tube securing devices

vital signs be required to identify the need for these interventions.

Section B: Ensure Basic Airway and Ventilatory Support, Prepare Airway Management Equipment

In most cases, basic airway and ventilatory support should be initiated before instituting advanced airway management. Basic airway management may be an effective temporizing tool in certain situations and may remain the primary airway method if advanced techniques fail or are not indicated. Many clinicians consider preoxygenation a necessary part of advanced airway management. Advanced airway techniques may also require considerable time for equipment setup and preparation.

In general, only bag–valve–mask (BVM) ventilation and non-rebreather masks are suitable for patients with airway or ventilatory compromise. BVM ventilation should be used on apneic or hypoventilating patients and, if possible, should be performed using a two-rescuer technique with an oropharyngeal or nasoparyngeal airway.[11] Non-rebreather masks with oropharyngeal or nasopharyngeal airway should be reserved for patients with adequate respiratory drive and effort. Except in unusual circumstances, low-flow oxygen delivery by nasal cannula should *not* be used on patients with airway or ventilatory compromise.

For each iteration through the algorithm, if basic airway and ventilatory support cannot be established or if the rescuer is not prepared to immediately perform ETI, rescuers should consider proceeding immediately to rescue airway insertion. Given the complexities of airway management in the prehospital setting, we discourage "rushed" ETI efforts, especially in the face of a rapidly deteriorating patient. We also strongly discourage the anecdotal practice of using ETI as a substitute for inadequate basic airway skills. Advanced airway management skills, even those that are excellent, can be meaningful only if basic airway skills are also mastered.

Once the need for airway or ventilatory support has been established, members of the rescue team should simultaneously prepare the equipment necessary for airway management (Table 2). Multiple pieces of equipment are required to perform advanced airway management. The proper and meticulous preparation of these items is crucial because in an airway management crisis situation, immediate access to needed equipment is mandatory. Anecdotal experience suggests that many prehospital airway management errors result from inadequate preparation of equipment. For example, rescuers often neglect to set up a suction unit until after the patient has vomited during laryngoscopy. Items that may be required (including a rescue airway) should be placed within immediate reach of the rescuer performing the airway management procedures.

Section C: Identify/Reassess Difficult Airway Traits

A key characteristic of the algorithm is that while the identification of difficult airway traits is recommended, there is no formal definition of a "difficult prehospital airway." Consequently, rescuers should not attempt to differentiate "easy" or "difficult" airways. Instead, they should anticipate and prepare to manage airway difficulty on every patient encounter.

This potentially controversial recommendation takes into account several important factors. First, in-hospital definitions of "difficult" airways (for example, the definition proposed by the American Society of Anesthesiology) have been based on in-hospital cohorts of patients and providers; these definitions are neither applicable to nor useful in the prehospital setting, an environment that encompasses widely different patient and

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provider populations.[1,12] Second, by virtue of the challenges of the prehospital environment, all prehospital airways contain some degree of inherent complexity. For example, prehospital patients requiring airway management are critically ill, and treatment may take place in unstable conditions such as in confined spaces or moving ambulances. Rescuer airway training and skill are variable. Rescuers also have only limited access to anesthetic or other agents (such as neuromuscular-blocking agents) for facilitating airway management.[13]

Several scoring systems have been proposed by anesthesiologists for assessing or describing the difficulty of an airway, for example, the Mallampati score and the Cormack-Lehane scale.[14–17] However, these scales have limitations in reliability and utility that preclude their application in the prehospital setting.[18–21]

Although there is no definition for a "difficult prehospital airway," rescuers may find it helpful to identify difficult airway *traits*, that is, factors that may complicate conventional airway management and reduce the chance for ETI success. Identifying traits during this step may prompt the selection of specific airway management interventions or techniques, as described in Section D. An increasing number of difficult airway traits may prompt the rescuer to lower the threshold for proceeding to rescue airway placement. Because it is unlikely that all potential difficult airway traits will be identified during the initial assessment, rescuers should strive to integrate information obtained from each successive ETI attempt.

Examples of difficult airway traits are listed in Table 3 and may be broadly classified as follows:

TABLE 3. Difficult Airway Traits

Level of consciousness and protective airway reflexes
Patient awake
Patient combative
Trismus/clenching
Intact gag reflex
Increased Glasgow Coma Scale (GCS) score
Anatomic factors
Obesity
Short neck
Large tongue
Small mouth/limited mouth opening
Overbite
Underbite
Anterior vocal cords
Large epiglottis
Poor neck flexibility
Anatomic anomaly
Facial or airway trauma
Mallampati score
"3-2-2" method
Environmental factors
Confined or restricted space
Entrapment
Intubation in ambulance or helicopter
Other factors
Traumatic condition
Cervical spine immobilization
Vomitus, blood, or secretions in airway
Epistaxis
Foreign body in airway
Inability to visualize vocal cords

- ***Level of Consciousness and Protective Airway Reflexes***. Patients who are awake, are combative, or have intact gag reflexes may be more difficult to intubate.[22–24]
- ***Anatomic Factors.*** The anesthesia literature has related many anatomic features to intubation difficulty, for example, obesity; head, neck, or jaw immobility; over- or underbite; atlanto-occipital gap; mandibular dimensions; and thyromental distance.[25–30] Although similar data for the prehospital setting are limited, it may be reasonable to extrapolate from these anesthesia-related findings.
- ***Environmental Factors.*** Experience suggests that the uncontrolled prehospital environment may increase the difficulty of ETI. For example, a small series suggests that in combat situations, alternate airway techniques are favorable over ETI.[31]
- ***Other Factors.*** Laryngoscopy is theoretically more difficult in prehospital trauma patients and may be due to direct injury to the airway as well as the need for cervical spine precautions. Blood, secretions, vomitus, and foreign bodies obscure laryngoscopic view and complicate intubation efforts in both trauma and medical patients.[23,24]

Section D: Select/Refine Airway Interventions or Techniques

Rescuers should select airway interventions or techniques by taking into consideration the difficult airway traits identified in Section C. It is impractical and perhaps impossible to define exact corrective actions for each difficult airway trait. Rescuers should select the most appropriate interventions and techniques based on the integration of information from each successive intubation attempt. Plans for additional strategies should be made *before* each intubation attempt. ETI should not be reattempted without a clear plan of corrective action.

Options for airway techniques and intervention are listed in Table 4. These options may be broadly classified as:

- ***Techniques Involving Patient or Rescuer Positioning.*** Adjustment of patient or rescuer positioning may improve laryngoscopic view. For example, the "sniffing" position and head-elevation techniques have been described in the otolaryngology, anesthesia, and emergency medicine literature and are generally believed to be helpful in improving glottic exposure.[32–37] A brief study suggested that elevating the backboard on immobilized trauma patients may improve intubation performance.[38] Several authors have described using prone or kneeling positions for intubating patients lying on the ground.[39–41] Techniques not formally studied but that appear to make sense clinically include raising the bed or stretcher to the level of the rescuer's waist, and placing the patient in a supine position.

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TABLE 4. Airway Management Techniques and Interventions

Techniques involving patient or rescuer positioning
Place patient in sniffing (head-elevated) position
Raise head/angle of backboard
Place patient supine
Raise bed/stretcher
Modified cervical-spine immobilization
Assume prone position
Assume kneeling position
Endotracheal intubation methods and techniques
Conventional OTI—curved blade
Conventional OTI—straight blade
Nasotracheal intubation
Apply cricoid pressure, external laryngeal manipulation (ELM), or "BURP" maneuver
Change tube size
Change tube shape
Change angle of laryngoscopy
Change laryngoscope blade (type or size)
Partially/completely withdraw stylet
Use Eschmann (gum elastic bougie) introducer
Use Endotrol endotracheal tube
Use BAAM
"Ice-pick" intubation
Drug-facilitated endotracheal intubation
Sedation-facilitated intubation (benzodiazepine or induction agent—without neuromuscular-blocking agents)
Rapid-sequence intubation (neuromuscular-blocking agents)
Topical anesthetic spray
Secondary/rescue airway techniques
See Table 5
Other techniques
Change rescuers
Move to a different environment
Defer ETI—support ventilation using BVM or non-rebreather mask

OTI = orotracheal intubation; BURP = backwards–upwards–rightwards–pressure; BAAM = Beck airway airflow monitor; ETI = endotracheal intubation; BVM = bag–valve–mask.

- ***ETI Methods and Techniques.*** Multiple techniques have been described for ETI. While not formally evaluated, changes in the selection of laryngoscope blade or endotracheal tube size or shape may facilitate successful intubation. Cricoid pressure, the backwards–upwards–rightwards–pressure ("BURP") technique, and external laryngeal manipulation have been described for improving vocal cord exposure during orotracheal intubation.[42–44] Nasotracheal intubation may be useful in patients for whom orotracheal techniques cannot be used because the patient has clenched teeth, has tongue edema, or requires a seated position.[45–47] Directional-tipped endotracheal tubes and the Beck airway airflow monitor (BAAM) may improve the success of nasotracheal intubation in selected prehospital patients.[46,48,49] The use of an Eschmann introducer (gum elastic bougie) has been described by two small prehospital studies.[50,51] Special techniques have been described for intubating patients who are entrapped in an upright position.[52]
- ***Drug-facilitated ETI.*** Drug-facilitated intubation involves the use of a pharmacologic agent to sedate or paralyze the patient prior to attempted ETI. Drug-facilitated intubation may be broadly categorized as either sedation-facilitated intubation (the use of sedative agents alone) or rapid-sequence intubation (RSI; neuromuscular-blockade-assisted intubation). Sedation-facilitated intubation has been described in several prehospital studies using agents such as midazolam and etomidate.[53–57] Rapid-sequence intubation has been described in multiple prehospital studies.[47,58–68] Topical anesthetic spray (such as atomized or nebulized tetracaine or lidocaine) is used by selected emergency medical services (EMS), but its utility for facilitating prehospital intubation has not been formally evaluated.[2]
- ***Secondary/Rescue Airway.*** These techniques and devices are discussed in greater detail below. Rescue airways are always acceptable alternatives to conventional ETI. Rescue airway use is preferable to multiple failed ETI attempts and is appropriate where the complexity of the airway or the difficulty of the setting exceeds the rescuer's ability to perform ETI, for example, in cases where extensive airway trauma precludes laryngoscopic visualization.
- ***Other Techniques.*** While not scientifically based, maneuvers commonly taught for improving intubation success include having another rescuer attempt laryngoscopy and moving the patient to a more controlled environment.

Section E: Attempt ETI—Is Proper Placement Confirmed?

There are currently no scientific data supporting the use of specific laryngoscopic techniques in the prehospital setting. Rescuers should attempt ETI using the methods in which they have been trained and are comfortable using.

To prevent desaturation during ETI attempts, it is typically recommended to limit laryngoscopy efforts to no more than 30 seconds.[9] Dunford et al. found that oxygen desaturations and bradycardia appeared to be linked to prolonged laryngoscopy attempts in paramedic ETI.[69] We note that while preoxygenation has been promoted as a technique to facilitate longer ETI attempts without desaturation, there are currently no data precisely describing the extent of this benefit on critically ill prehospital patients.

Confirmation of tube placement is a critical task in the airway management process and is currently accomplished using a combination of physical findings and tube placement detection devices.[70,71] Although rescuers are traditionally taught to verify endotracheal tube placement by using a series of physical findings (direct visualization, auscultation of chest and epigastrium, and observation of chest rise), most of these techniques have not been formally evaluated. There are also limited reports of the inaccuracy of these methods; for example, according to one animal series, tube condensation does not accurately indicate proper tube location.[72] There has

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been increasing emphasis on the use of tube placement detection devices such as the esophageal detector device (EDD) and the Toomey syringe.[73–77] Colorimetric, digital, or waveform end-tidal carbon dioxide detection devices are gaining favor as the best methods for confirming tube placement in the prehospital setting.[71,78,79]

A position statement issued by the NAEMSP recommends that multiple methods should be used to confirm tube placement.[71] However, we note that there are currently no data indicating the exact number or sequence of methods that should be used. If proper tube placement cannot be confirmed, the rescuer should remove the tube and immediately proceed to the tasks described in Section G of the algorithm.

Section F: Secure the Airway Device and Ensure Adequate Ventilation

Once it is determined that the endotracheal tube is correctly placed, the tube should be secured. Methods commonly used for securing the endotracheal tube include adhesive tape, woven "umbilical" tape, and commercial tube holders, as well as improvised techniques such as friction loops of intravenous tubing or oxygen tubing. While not specifically supported by scientific data, the American Heart Association Advanced Cardiac Life Support guidelines currently recommend using a commercial tube holder in addition to the application of a cervical collar or head immobilization device.[11,80]

Reverification of proper placement and confirmation of adequate ventilation should take place immediately after securing the tube.

Section G: Have There Been Three ETI Attempts?

An intubation attempt is defined by NAEMSP standards as a single insertion of the laryngoscope blade.[8] If the rescuer has performed only one or two ETI attempts, it may be reasonable to return to Section B (basic airway and ventilatory support) of the algorithm and proceed again through the airway management algorithm. If three attempts are made without successful placement of the endotracheal tube, the rescuer should proceed immediately to Section H and attempt placement of a rescue airway. It is acceptable to proceed immediately to a rescue airway at any time prior to three laryngoscopy attempts.

Data suggest that the probability of successful ETI may decrease with each successive ETI attempt.[81] The purpose of the three-attempt limit is to prevent futile ETI efforts. Although this threshold is used by many EMS services, individual services may adopt thresholds that are lower (personal communications, Megargel R, State of Delaware EMS, January 2004; Roth R, City of Pittsburgh EMS, February 2004). The recommended threshold is based on common clinical practice; there are currently no scientific data delineating the maximum safe number of ETI attempts.

Sections H and I: Secondary/Rescue Airway

An important goal of the algorithm is to provide for the timely placement of a secondary/rescue airway when ETI efforts are unsuccessful or are likely futile. Rescuers should have a low threshold for proceeding to rescue airway use because these devices are relatively easy to insert and generally result in satisfactory ventilation.[11]

Commonly used rescue airway techniques are listed in Table 5. The Combitube (dual-lumen airway) is included in the Emergency Medical Technician–Paramedic National Standard Curriculum and is used widely in both advanced and basic-level prehospital services in the United States.[82–86] The laryngeal mask airway (LMA) is widely accepted in the operating room, has been recommended as alternative airways for use by basic-level rescuers, and has been favorably described in prehospital clinical application.[11,80,87–91] The prehospital application and complications of transtracheal jet ventilation (TTJV) and cricothyroidotomy have been described by limited series.[92–98] Techniques alternative to conventional laryngoscopy are listed but are supported by in-hospital case series only.[99–103]

Although BVM is listed as secondary/rescue airway technique, data suggest that BVM ventilation is extremely difficult to perform properly. Consequently, this method should be used only when other methods cannot be instituted.[11,80] If BVM is necessary, a two-rescuer ventilation technique is preferred.[11]

TABLE 5. Secondary/Rescue Airway Techniques

Rescue airway devices
Combitube
Laryngeal mask airway (LMA)
Intubating laryngeal mask airway (ILMA)
Transtracheal needle jet ventilation (TTJV)
Cricothyroidotomy (open and other techniques)
Variations in endotracheal intubation technique
Digital intubation
Retrograde intubation
Lighted stylet intubation
Other methods
Bag–valve–mask with oropharyngeal/nasopharyngeal airway (preferably 2 or 3-rescuer technique)
Non-rebreather with oropharyngeal/nasopharyngeal airway (if spontaneous ventilations present)
Continuous positive airway pressure (CPAP)/bilevel positive airway pressure (BiPAP)

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The use of a non-rebreather mask with 100% supplemental oxygen may be acceptable where the patient has adequate ventilatory drive and protective airway reflexes that prevent the insertion of a rescue airway. While not specifically secondary/rescue airway techniques, bilevel positive airway pressure (BiPAP) and continuous positive airway pressure (CPAP) have been described in pilot series as potential alternatives for spontaneously breathing patients.[104–106]

Finally, supportive airway management using only BVM or nonrebreather mask may be appropriate when there is a short transport time to the receiving medical facility. Both ETI and the insertion of a rescue airway may require considerable amounts of time.[107] Anecdotal experience suggests that ETI of some patients may be more easily and safely accomplished in the emergency department (ED) setting. Rescuers must consider on a case-by-case basis whether the potential benefits of field ETI or rescue airway placement outweigh rapid transport to the receiving ED for airway management.

Section J: Reconfirm Tube Placement Frequently

Unlike in-hospital patients, prehospital patients require movement and transport over considerable distances, which may result in inadvertent displacement of an airway device. Recent data confirm that endotracheal tube dislodgment may be a common problem in the prehospital setting.[70,81,108] Therefore, reconfirmation of the proper position of the airway device (endotracheal tube or other) should occur frequently as part of the airway management process. Although desirable, the continuous monitoring of the location of an airway device, usually possible only with waveform capnography or digital capnometry, is not presently in widespread use in the prehospital setting in the United States. Consequently, endotracheal tube or airway placement generally must be manually reconfirmed on a periodic basis using methods such as those listed in Section E.

There are currently no scientific data to support using specific time intervals for reconfirming airway placement. However, it is reasonable to reconfirm airway placement after initial securing of the tube, after each time the patient is physically moved, at regular intervals (for example, every 5 minutes) during transport, and as part of the transfer of patient care between providers. Airway placement should also be reconfirmed when there is a change in physiologic status, for example, oxygen desaturation or bradycardia.

CONCLUSION

We propose the Prehospital Airway Management Algorithm. This algorithm provides a structured conceptual guideline for efficiently managing the airway in critically-ill prehospital patients. The algorithm provides a tool with potential for ensuring patient safety and reducing errors during airway management. The algorithm also provides a framework for training prehospital rescuers in the process of airway management.

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