30

Difficult and Failed Airway Management in EMS

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THE CLINICAL CHALLENGE

The prehospital environment presents an array of unique circumstances to the airway practitioner: The scene is often chaotic and may pose hazards to the emergency medical services (EMS) personnel (e.g., flood, fire, radiation, electrical wires, toxic environment, etc.). In addition, access to the patient and the airway may be challenging because of a variety of factors related to extrication and patient or paramedic position. Even with the patient on a stretcher in an ambulance or helicopter, positioning for airway management may be difficult. In fact, some would argue that all airway management in the field is difficult, particularly if more than basic maneuvers are to be used.

Environmental conditions faced by EMS providers are uncontrollable: both the darkness of night and bright sunlight of day present unique difficulties. Dark environments may hinder the preintubation airway assessment and obscure nonverbal communications among personnel that are inherent in complex rescue environments. Alternatively, bright sunlight is likely to interfere with laryngoscopic visualization of the larynx. Weather conditions, scenes of violence, tactical rescue, large crowds, equipment limitations, well-meaning bystanders, lack of knowledgeable assistants, and other factors conspire to enhance the degree of difficulty posed to the EMS airway manager.

Identifying a difficult airway and managing a failed airway are both technical skills that are no different in the out-of-hospital environment than they are in-hospital. Thus, the cognitive and technical skills required of prehospital practitioners are comparable to those practicing in emergency departments (EDs), operating rooms (ORs) and other in-hospital venues, differences in available equipment and backup notwithstanding.

FACTORS SPECIFIC TO THE OUT-OF-HOSPITAL DIFFICULT AIRWAY

There are two interrelated considerations governing management of the difficult airway in the prehospital environment: time factors and anatomical factors.

Time Factors

When is it better to wait?

Although all emergency airway management situations share this feature, identification of a difficult airway might influence the provider either to be more or less likely to intubate the patient before transport. Consider, for example, the following two cases, each with an anticipated 10-minute transport time:

- A 40-year-old, 80-kg man with sudden collapse, Glasgow Coma Scale 6, with no swallowing reflex, normal respiratory pattern with \( O_2 \) saturations of 99%, and severe ankylosing spondylitis.
- A 40-year-old, 80-kg man extricated from a house fire, with stridor, \( O_2 \) saturations of 70%, and evidence of upper airway burns.

Both patients have clear indications for securing the airway, although the decision making, particularly with respect to urgency, should be quite different.

In the first case, if the patient is not deteriorating further, it often is best to defer intubation to the ED, where a more formal and controlled neuroprotective RSI can be performed and there are additional options, such as flexible endoscopy, for this difficult airway. The patient’s respiratory status, and his or her oxygen saturation, are adequate. Training must emphasize that preservation of vital functions equates to gas exchange, and does not necessarily equate to endotracheal intubation. Additionally, the patient has a chronic difficult airway, one that will not become increasingly difficult if intubation is delayed. The provider and system medical directors must be wary of the technical imperative—that operators generally will perform an authorized procedure more often...
than it is required or indicated. In fact, there is growing evidence that in certain situations, prehospital intubation may not improve outcomes, and may even lead to worse outcomes, and may even lead to worse outcomes.

In the second case, the operator is forced to actively manage the airway despite predicted difficulty with laryngoscopy. Even a brief delay, such as a 10-minute transport, allows time for further deterioration, increasing the threat to the patient and making intubation progressively more difficult. The decision to intubate here is clear, and the provider must proceed deliberately down the EMS Difficult Airway Algorithm (Fig. 30-1).

**Anatomic Factors**

**Predicting the difficult airway**

The preintubation airway assessment is essential to identify patients likely to present difficulties for laryngoscopy, bag-mask-ventilation (BMV), extraglottic device (EGD) placement, or cricothyrotomy based on a focused examination of external anatomic features (see Chapter 2). This evaluation permits one to make appropriate airway management plans (Plans A, B, and C) that are most likely to be successful.

The patient with acceptable oxygen saturations and a short transport time displaying predictors of difficult laryngoscopy might be better served by a timely transport to the nearest ED, where

![Figure 30-1](image)

**The EMS Difficult Airway Algorithm.** See discussion of the Difficult Airway Algorithm in Chapter 3 for explanation. RSI, rapid sequence intubation or other medication-assisted intubation technique; PIM, post-intubation management; EGD, extra-glottic device; ILMA, intubating laryngeal mask airway; VL, video laryngoscopy; BNTI, blind nasal tracheal intubation.
there are more resources and skilled personnel. This is particularly the case when the difficult airway is chronic or stable, and is not the reason the patient requires intubation. For example, consider the 40-year-old patient above, who had experienced sudden collapse. Suppose that the anticipated transport time is not 10 minutes, but 20 minutes. Suppose also that preintubation assessment identifies that the patient has had head and neck surgery and radiation for cancer, and has limited mouth opening, neck scarring, and some distortion of anatomy. The difficult airway here is stable and will not worsen during transport to an ED, thus making even more compelling the decision to defer intubation until after ED arrival. This extends the window of time that is “acceptable” for transport without intubation because the risk/benefit ratio argues in favor of taking the patient, unintubated, to the ED. This is in stark contrast to the second patient described above with upper airway burns and stridor. Consider this patient in the context of a 5-minute transport time. Here, regardless of how short the transport time is, the likelihood of imminent deterioration both compels intubation and argues for undertaking this at the earliest opportunity. Thus, both the nature and the “stability” of the difficult airway become key factors in the “intubate versus transport” decision. This has been identified as ‘context sensitive’ airway management.

APPLYING THE EMS DIFFICULT AIRWAY ALGORITHM

When intubation of a difficult airway is required, the EMS Difficult Airway Algorithm (Fig. 30-1) directs one to weigh carefully the RSI (or other medication-assisted intubation) versus “awake” intubation decision. The thought process is identical to that described in Chapter 3. At any point after initiation, if the chosen method is unsuccessful, and oxygenation cannot be maintained, one should move promptly to the failed airway algorithm (Chapter 3). In situations where difficulty is predicted, and airway management is urgently indicated, securing help using on-scene personnel is advisable. The most difficult airways encountered in the prehospital setting often are those arising in the context of multisystem trauma. The patient may not be able to follow commands or answer questions related to difficult airway assessment, and injuries may be occult. Facial fractures may impede an effective mask seal but may not be readily apparent in a cursory examination. The front portion of the cervical collar might conceal significant injuries to the patient’s anterior neck; without opening the collar, the operator has little or no chance of identifying the injuries. Neck mobility may be one factor that the provider has some control over. The immobilization of the cervical spine is known to provide a grade 3 Cormack lehane (C-L) view on direct laryngoscopy approximately 50% of the time. In anticipation of this, the intubator should ready a gum elastic bougie (GEB), if available, or should preferentially a video laryngoscope or optical device, like the Airtraq (see Chapters 13 and 14). When the laryngeal view with immobilization prohibits intubation, the provider must relax immobilization in small increments to permit visualization and intubation. Controlled and cautious cervical spine motion in this circumstance, where the integrity of the spinal column is uncertain, presents less risk to the patient than does failure to assure gas exchange.

Detailed assessment for difficult airway markers is conducted as described in Chapter 2. If a difficult airway is identified, the EMS difficult airway algorithm guides the approach to airway management in the prehospital patient (Fig. 30-1).

The major differences between the difficult airway algorithm pictured in Figure 30-1 and that presented in Chapter 3 are as follows:

- A “scoop and run” option is offered once a difficult airway is predicted. This represents a decision to “scoop and run” to the nearest appropriate receiving center, or to divert the transport to such a center. Such a decision is based on the urgency of the need for emergency airway management, the assessed difficulty, the estimated time required for transport, and available equipment. It requires judgment on the part of requires judgment on the part of the operator. The benefit of transport to a higher level of care is weighed against the risk of delaying airway management for that period of time. Conversely, the benefit of immediate intubation on the scene is weighed against the risk
of undertaking management of a difficult airway in a suboptimal environment with less equipment and back up available.

- The EMS algorithm allows for a variety of system-specific approaches to medication-assisted intubation, whereas the algorithm in Chapter 3 specifies RSI.
- The options once a failed awake intubation has occurred are limited to the use of an EGD, video laryngoscopy, blind nasal intubation, and surgical airway. In Chapter 3, there is the additional option of flexible endoscopy, which is not available in the out-of-hospital environment.

Nevertheless, the thought processes in the two algorithms are identical.

The “forced to act” situation is a particular scenario, and is discussed in depth in Chapter 3. Similar principles apply here as in the ED or hospital environment. As discussed earlier, transport time also should be considered when determining whether it is appropriate to perform a drug-assisted intubation. Again, in many settings, especially urban systems with short transport times, transport to the ED may be preferable to struggling with a difficult airway in the prehospital setting.

Enhancement of the devices available, particularly video laryngoscopy, or even simple adjuncts, such as GEB, may increase first attempt success rates, particularly in the immobilized patient.

THE FAILED AIRWAY IN EMS

The definitions of the failed airway are essentially the same in the EMS environment as those presented in Chapters 2 and 3: failure to maintain oxygenation by any means and failure to intubate on three attempts. Two clinical situations are presented: cannot intubate, can oxygenate: have time; cannot intubate, cannot oxygenate: have no time. This latter circumstance is often referred to using the abbreviation CICO.

The failed airway algorithm is used as described in Chapter 3. However, decisions at any point are influenced by the devices available to EMS providers, and the skills that they are permitted to perform, as specified by protocol (see Chapter 28).

Although limited resources are available in the field, the use of a second, experienced provider should always be given immediate consideration when the airway is identified as very difficult. The second operator may assist with initial airway management and be designated to attempt placement of an EGD in the case of CICO, while the first operator prepares for the cricothyrotomy. In rare cases, for example, in a patient with lacerations through the soft tissues of the oropharynx and a disrupted upper airway, the airway may best be secured by immediate cricothyrotomy if field protocols permit, and the provider is appropriately trained.

Not infrequently, the prehospital provider will be faced with a failed intubation. A failed intubation is usually multifactorial; the result of an anatomically challenging patient, time pressures, equipment limitations, and, often, provider experience and judgment.

AIRWAY RESCUE

Traditionally, BMV has been the primary rescue device for failed intubation in the out-of-hospital setting, although practice is evolving as more experience is gained with EGDs. Nonetheless, prehospital providers must be expert at BMV using both one-handed and two-handed mask hold techniques, supplemented by oral and nasopharyngeal airways. If BMV is inadequate at providing effective gas exchange, the patient should be repositioned, the jaw thrust maneuver should be applied fully, oral and nasal airways should be placed (if not already), a two-handed technique should be used to seal the mask to the patient, and any other steps should be taken that the operator determines might be helpful (see Chapter 9). A subjective sense that BMV is inadequate or failing
should motivate the prompt placement of an EGD. Meticulous BMV and rapid transport might be the appropriate action, however, if oxygenation is adequate and intubation appears difficult or impossible.

If intubation is unsuccessful, it is important to attempt to determine why. Chapter 12 describes the sequence of steps involved in successful direct laryngoscopy. Repositioning the head and neck, backward upward rightward pressure on the thyroid cartilage, a change in blade size or type, or even a change in operator may help.

When laryngoscopy fails and no appropriate rescue devices are available, digital or tactile intubation may be an option in experienced hands (Chapter 17). Although true indications are exceedingly rare, digital intubation requires no specialized equipment and obviates the need to visualize the glottis, or to reposition the head and neck. Some EMS systems permit cricothyrotomy to be performed in the prehospital setting. If this is the case, adequate training and skill maintenance are important. Cricothyrotomy in the field should be an exceedingly rare event. Cricothyrotomy accounts only for approximately 1% of all ED intubations; the incidence among out-of-hospital intubations should be even lower. Performance of a cricothyrotomy, or the identification and attempted rescue of any failed airway, should be subject to quality review.

**TIPS AND PEARLS**

- In the prehospital environment the use of two providers for the identified difficult airway may prove to be the best use of limited personnel, saving time and preventing complications for patients.
- If possible, have a GEB readily available, particularly for patients in spinal immobilization.
- If manual in-line stabilization of the C-Spine is preventing intubation, ask the individual providing the immobilization to "give me a centimeter" and do so centimeter by centimeter until the ETT can be passed.
- The life of the patient is of paramount importance. Do not delay recognizing intubation failure, and transitioning to an EGD or BMV.
- Monitor end tidal carbon dioxide continuously to detect inadvertent tube dislodgement.
- Avoid the use of neuromuscular blocking agents or potent sedative agents unless you are confident in your ability to provide ongoing, effective gas exchange.

**EVIDENCE**

- **Is there any evidence that experienced prehospital providers perform better than less experienced ones?** There is, and it is related specifically to the number of airways managed. Garza et al. found that the number of patients in whom intubation was attempted per paramedic was significantly correlated with the intubation success rate. Months of experience per paramedic had no significant correlation with intubation success rate. The investigators also found that paramedics frequently operate under poor environmental conditions and encounter significant distractions while attempting to perform endotracheal intubation.

  Wang et al. found that greater numbers of intubations per practitioner increased success rates. Perhaps the more important finding in this study, however, was that as the experience level of the practitioner increased, the numbers of intubations performed decreased. The implication is that more experience permitted practitioners to use alternative methods, perhaps, because they were able to predict intubation difficulty.

- **Is there evidence that the GEB enhances intubation success rates in EMS?** Evidence specific to EMS does not exist. However, there is ample evidence that success rates and time to in-
tubate are enhanced by this simple device in the hands of anesthesiologists and emergency physicians.\textsuperscript{4,5}

- **How common is the difficult and failed airway in EMS?** The incidence of the difficult airway in the OR setting is 1.1% to 3.8% with the failed intubation occurring at 0.13% to 0.3% of cases (see also Chapter 2).\textsuperscript{6} So, it is not uncommon to see a difficult airway even in the OR. The incidence of difficult intubation in EMS, where equipment and support are limited, and patients cannot be deferred based on a “preanesthetic” assessment, is 3 to 10 times that seen in the OR, at 11%.\textsuperscript{7} Studies of prehospital endotracheal intubation have reported failed intubation rates from 3.4% to 25%.\textsuperscript{8,9} It is this variation that has called into question the advisability of prehospital care personnel performing endotracheal intubation in general, and RSI in particular (see Chapter 28).

**REFERENCES**