CHAPTER 5

The Emergency Airway Algorithms

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APPROACH TO THE AIRWAY

This chapter presents and discusses the emergency airway algorithms, which we have used, taught, and refined for nearly 25 years. These algorithms are intended to reduce error and improve the pace and quality of decision-making for an event that is uncommonly encountered by most practitioners, and often disrupts attempts at sound and orderly clinical management.

When we first set out to try to codify the cognitive aspects of emergency airway management, we were both liberated and impaired by the complete lack of any such algorithms to guide us. In developing The Difficult Airway Course: Emergency, The Difficult Airway Course: Anesthesia, The Difficult Airway Course: Critical Care, and The Difficult Airway Course: EMS, and in applying, successively, each iteration of the emergency airway algorithms to tens of thousands of real and simulated cases involving thousands of providers, we felt guided by both our continuous learning about optimal airway management and the empirical application of these principles. They are based on both the best evidence available and consensus of the most reputable experts in the field of emergency airway management. These algorithms, or adaptations of them, now appear in many of the major emergency medicine textbooks and online references. They are used in airway courses, for residency training, and in didactic teaching sessions, both for in-hospital and out-of-hospital providers. They have stood the test of time and have benefited from constant updates.

The adoption of video laryngoscopy (VL) as the emergency airway manager's principal tool has caused us to rethink concepts related to the definition and management of the "difficult airway" (see Chapters 2 and 3). This sixth edition includes the foundational concepts of our proven algorithmic approach to airway management augmented by a new cardiac arrest airway algorithm and the integration of flexible intubation methods, VL, and a focus on, especially during rapid sequence intubation (RSI), "physiologic optimization". This step is designed to recognize and address patients with impaired oxygenation or poor cardiovascular reserve and, by doing so, create safer intubating conditions. Although we describe this as a discreet step during RSI (see Chapter 20), optimization of oxygenation and hemodynamics should occur, if time and resources allow, during *all* emergency intubations. Extraglottic devices (EGDs) continue to be refined, are easy to use, can facilitate tracheal tube placement, and most offer the benefits of gastric decompression. Surgical airway management, although still an essential skill, moves from uncommon to rare as the sophistication of first-line devices, rescue tools, and safe intubation practices increases.

Together, as before, these algorithms comprise a fundamental, *reproducible* approach to the emergency airway. The purpose is not to provide a "cookbook" or a rigidly followed blueprint which one could universally and mindlessly apply, but rather to describe a reproducible set of decisions and actions to enhance performance and maximize the opportunities for success, even in difficult or challenging cases.

The specialized algorithms all build from concepts found in the universal emergency airway algorithm, which describes the priority of the key decisions: determining whether the patient represents a cardiac arrest airway, an anatomically or physiologically difficult airway, or a failed airway. In addition, we recommend achieving physiologic optimization as an essential step in all airway management, considering the patient's condition as well as the time and resources available. The decision to intubate is discussed in Chapter 1, and the entry point into the emergency airway algorithms is immediately after the decision to intubate has been made.

The "forced to act" option, part of the difficult airway algorithm, is maintained for this update. There are clinical circumstances in which it is essential to use neuromuscular blocking agents (NMBAs) even in the face of obvious airway difficulty, simply because the need for intubation is immediate and there is little time to plan any other approach. The operator who is *forced to act* uses an induction agent and an NMBA to create the best possible conditions for intubation—in other words, to facilitate the one best chance to secure the airway and for successful rescue should the primary method fail. The forced to act option implies a time-critical need for intubation because of a dynamically changing airway or rapidly deteriorating patient. An example of this might be the morbidly obese difficult airway patient who prematurely self-extubates in the intensive care unit (ICU) and is immediately agitated, hypoxic, and deteriorating. Although the patient's habitus and airway characteristics normally would argue against the use of RSI, the need to secure the airway within a few minutes and the patient's critical deterioration mandate immediate action. By giving an NMBA and induction agent, the operator can optimize conditions for VL, with a plan to either insert a laryngeal mask airway (LMA) or perform a surgical airway if unsuccessful. In rare cases, the primary method may be a surgical airway.

The algorithms are intended as guidelines for management of the emergency airway, regardless of the locus of care (emergency department [ED], inpatient unit, operating room, ICU, and out-of-hospital). The goal is to simplify some of the complexities of emergency airway management by defining distinct categories of airway problems. For example, we single out those patients who are agonal or coding and manage them using a distinct pathway, the cardiac arrest airway algorithm. Similarly, a patient with an anatomically difficult airway must be identified and managed according to sound principles.

Significant anatomic distortion will impede effective laryngoscopy and tube placement and would be a relative contraindication to RSI. If it is anticipated that critical hypoxemia might occur before tracheal intubation is completed, then an awake intubation should be performed. An example of this might be a patient with Ludwig's angina who arrives with difficulty breathing, trismus, and upper airway obstruction. In this case, traditional orotracheal intubation, even with VL, is anticipated to be difficult or impossible and rendering the patient apneic would likely create a failed airway scenario.

VL has mitigated many, but not all, of the hazards that challenging anatomy imposes on direct laryngoscopy. The threshold for using RSI, in the context of difficult anatomy, has appropriately gone down. However, this has been supplanted by an increasing awareness that deranged physiology can introduce as much risk to emergency airway management as challenging anatomy. For the sixth edition, we have updated the difficult airway algorithm so that compromised physiology is considered before final airway management plans are made.

In human factors analysis, failure to recognize a pattern is often a precursor to medical error. The algorithms aid in pattern recognition by guiding the provider to ask specific questions, such as "Is this airway difficult?" and "Is this a can't intubate and can't oxygenate (CICO) failed airway?" The answers to these questions group patients with certain characteristics together and each group has a defined series of actions. For example, in the case of a difficult airway, the difficult airway algorithm facilitates formulation of a distinct, but reproducible plan, which is individualized for that particular patient, yet lies within the overall approach that is predefined for all patients in this class, that is, those with difficult airways.

Algorithms are best thought of as a series of *key questions* and *critical actions*, with the answer to each question guiding the next critical action. The answers are always binary: "yes" or "no" to simplify and speed cognitive factor analysis. **Figures 5.1** and **5.2** provide an overview of the algorithms, and how they work together.

When a patient requires intubation, the first question is "Is this patient agonal or in arrest?" A patient that is agonal or in full arrest would qualify for cardiac arrest airway management, which has replaced the concept of the "crash airway" for this sixth edition. The crash airway was

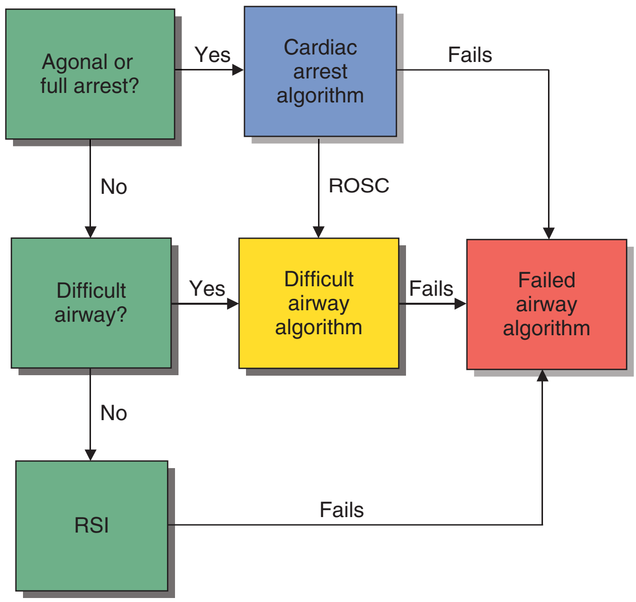

Figure 5.1: Universal emergency airway algorithm. This algorithm demonstrates how the emergency airway algorithms work together. For all algorithms, green represents the main algorithm, yellow is the difficult airway algorithm, blue is the crash airway algorithm, red is the failed airway algorithm, and orange represents an end point. (© 2022 The Difficult Airway Course: Emergency.)

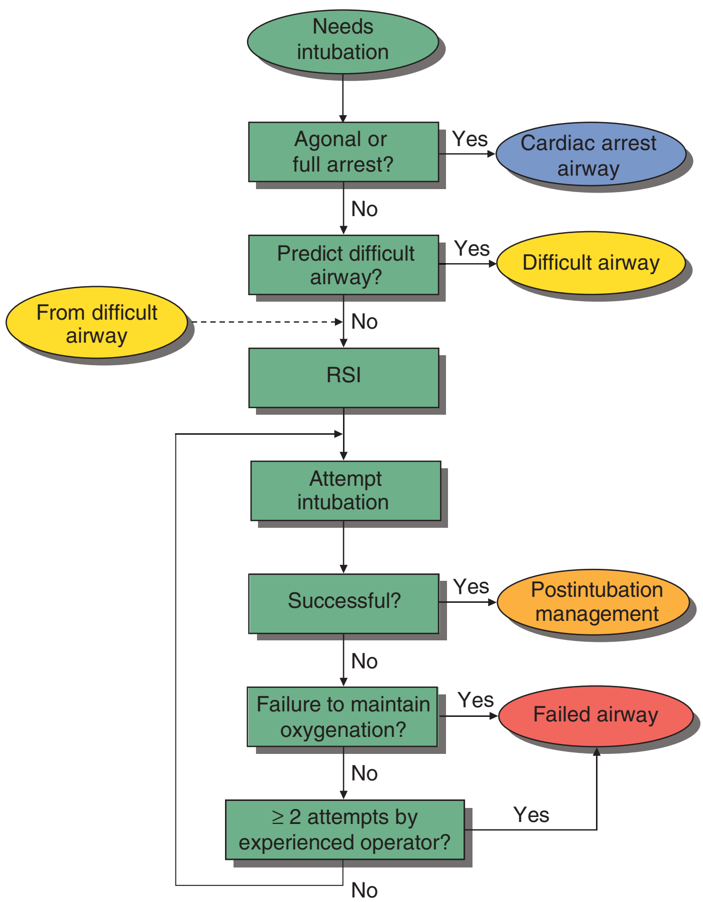

Figure 5.2: Main emergency airway management algorithm. See text for details. (© 2022 The Difficult Airway Course: Emergency.)

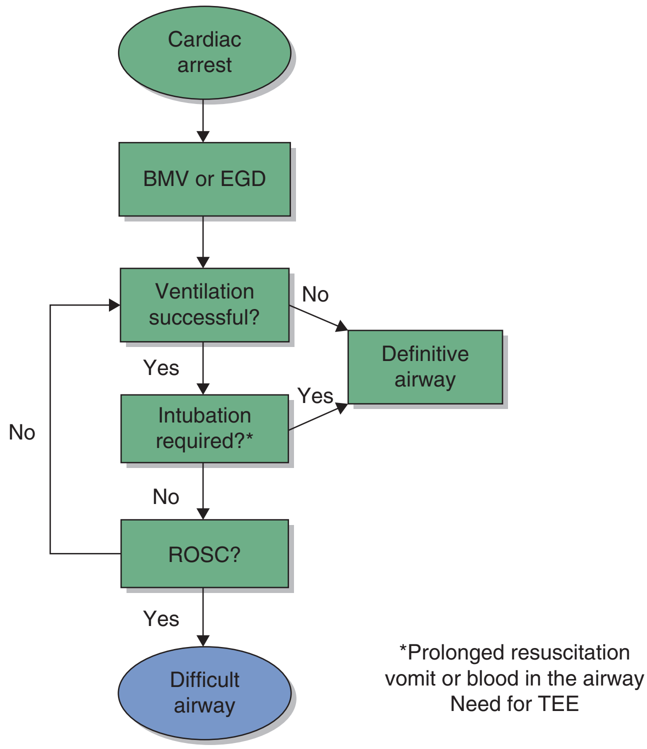

Figure 5.3: Cardiac arrest airway algorithm. *Prolonged code, vomiting or bleeding in the airway, transesophageal echocardiogram (TEE). BMV, bag-mask-ventilation; EGD, extraglottic device; ROSC, return of spontaneous circulation. (© 2022 The Difficult Airway Course: Emergency.)

historically meant to describe patients who needed emergent intubation and were transitioning from critical illness to full respiratory or cardiac arrest. The opportunity to catch patients in this rapid transition is rare. In practice, patients present either critically ill, for whom physiologic optimization is the priority along with airway management (see Chapter 20), or cardiorespiratory arrest for whom airway management typically involves bag-mask-ventilation (BMV) or placement of an EGD followed by definitive airway management if there is return of circulation. If the answer is "yes," the patient should be managed using the cardiac arrest airway management algorithm (**Fig. 5.3**) with BMV or EGD placement during active cardiopulmonary resuscitation (CPR). Plans for intubation can be made if the patient is successfully resuscitated or, if still in arrest, the provider decides a definitive airway is required because of vomit, a prolonged code, or need for procedures that mandate a tracheal tube be placed (eg, transesophageal echocardiogram [TEE]). If the answer is "no," the next question is "Is this a difficult airway?" (see Chapters 2 and 3). If the answer is "yes," the patient is managed as a difficult airway (**Fig. 5.4**). If the answer is "no," then RSI is recommended, as described on the main algorithm (Fig. 5.2). Regardless of the algorithm used initially, if airway failure occurs, the failed airway algorithm is immediately invoked (**Fig. 5.5**). The working definition of the failed airway is crucial and is explained in much more detail in the following sections. It has been our experience that airway management errors occur because the provider either does not recognize the situation (eg, failed airway), or does not know what actions to take.

THE MAIN AIRWAY ALGORITHM

The main emergency airway algorithm is shown in Figure 5.2. It begins after the decision to intubate and ends when the airway is secured, whether intubation is achieved directly or through one of the other algorithms. The algorithm is navigated by following defined steps with decisions driven by the answers to a series of key questions as follows.

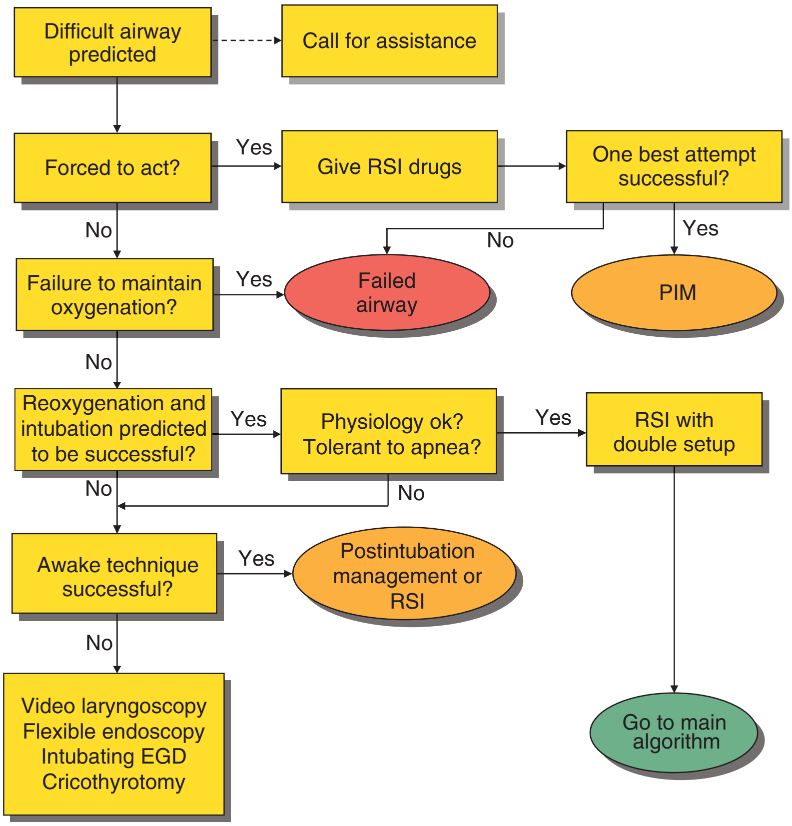

Figure 5.4: **Difficult airway algorithm.** See text for details. EGD, extraglottic device. PIM, postintubation management. RSI, rapid sequence intubation. (© 2022 The Difficult Airway Course: Emergency.)

Key question 1: Is the patient agonal or in full cardiorespiratory arrest?

If the patient is agonal or in full arrest for whom CPR is either in progress or about to begin, then the patient is defined as a cardiac arrest airway. These patients are often relaxed, unlikely to resist invasive airway maneuvers, and managed in a manner appropriate for their extreme condition. If a cardiac arrest airway is identified, exit the main algorithm and enter the cardiac arrest airway algorithm (Fig. 5.3). Otherwise, continue with the main algorithm.

Key question 2: Is this a difficult airway?

If the airway is not a cardiac arrest airway, the next task is to determine whether it is a difficult airway. An airway may be difficult because of altered anatomy, or severely deranged physiology. With the former, anatomic challenges make visualization of the airway challenging and may preclude successful tracheal intubation. With the latter, peri-intubation adverse events may occur, not because of inability to place a tracheal tube, but because myocardial depression, hypotension, and positive pressure ventilation can result in circulatory collapse. Anatomic difficulty encompasses difficult DL or VL intubation, difficult BMV, difficult EGD use, and difficult cricothyrotoimy. Chapter 2 outlines the assessment of the patient for a potentially difficult anatomic airway using the various mnemonics (LEMON, ROMAN, RODS, and SMART) corresponding to these dimensions of difficulty. Difficult VL is rare if there is enough mouth opening to allow insertion of the device. Although some predictive parameters have started to become identified, a validated set of patient characteristics is yet to be defined. Identification of the difficult physiologic airway is discussed in Chapter 3. The elements are recalled by the CRASH mnemonic. It is understood that virtually all emergency intubations are difficult to some extent. However, the evaluation of

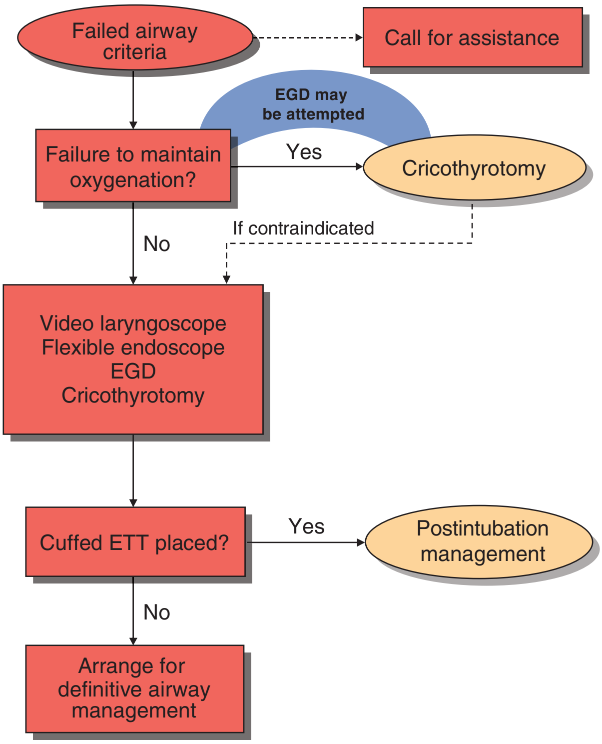

Figure 5.5: Failed airway algorithm. See text for details. EGD, extraglottic device; ETT, endotracheal tube. (© 2022 The Difficult Airway Course: Emergency.)

the patient for attributes that predict difficult airway management is extremely important. If the patient represents a potential difficult airway situation, then he or she is managed using the difficult airway algorithm (Fig. 5.4), and one would exit the main algorithm. The LEMON assessment for difficult laryngoscopy and intubation and the ROMAN assessment for difficult reoxygenation with BMV or an EGD are the main drivers of predictable anatomic airway challenges; however, an evaluation of the other difficulties (cricothyrotomy and EGD) is critical at this point as well. If the airway is not identified as particularly difficult, continue with the main algorithm to the next step, which is to perform RSI.

Critical Action: Perform RSI

In the absence of an identified cardiac arrest or difficult airway, RSI is the method of choice for emergency intubation. RSI is described in detail in Chapter 20 and affords the best opportunity for success with the least likelihood of adverse outcome of any possible airway management method, when applied to appropriately selected patients. This step assumes that the appropriate sequence of RSI (the seven Ps) will be followed. If the patient is hemodynamically unstable and the need for intubation is *not* immediate, an effort to optimize patient physiology should occur as plans for intubation are finalized and drugs are drawn up. During RSI, intubation is attempted. According to the standard nomenclature of the National Emergency Airway Registry (NEAR), a multicenter study of emergency intubations, *an attempt is defined as activities occurring during a single continuous laryngoscopy maneuver, beginning when the laryngoscope is inserted into the patient's mouth, and ending when the laryngoscope is removed, regardless of whether a tracheal tube is actually inserted into the patient.* In other words, if several attempts are made to pass an endotracheal tube (ETT) through the glottis during the course of a single laryngoscopy, these aggregate efforts count as one attempt. If the glottis is not visualized and no attempt is made to insert a tube, the laryngoscopy is still counted as one attempt. These distinctions are important because of the definition of the failed airway that follows.

Key question 3: Was intubation successful?

If the first oral intubation attempt is successful, the patient is intubated, postintubation management (PIM) is initiated, and the algorithm terminates. If the intubation attempt is not successful, continue with the main pathway.

Key question 4: Can the patient's oxygenation be maintained?

When the first attempt at intubation is unsuccessful, it often is possible and appropriate to attempt a second laryngoscopy without interposed BMV, as oxygen saturations often remain acceptable for an extended period following proper preoxygenation. Desaturation can be delayed even further with apneic oxygenation, the continuous delivery of supplemental oxygen by nasal cannula during RSI. In general, active BMV is not necessary until the oxygen saturation falls below 94%. Because peripheral oxygen saturation readings often lag behind actual oxyhemoglobin levels and the rate at which hemoglobin releases its oxygen stores accelerates at this point, it is appropriate to abort laryngoscopic attempts when oxygen saturations fall below 94% and begin rescue mask ventilation. This approach underscores the importance of assessing the likelihood of successful reoxygenation by BMV or EGD (ROMAN, see Chapter 2) before beginning the intubation sequence. In most cases, especially when neuromuscular blockade has been used, BMV will provide adequate ventilation and oxygenation for the patient. If BMV is not capable of maintaining the oxygen saturation at or above 94%, a better technique including oral and nasal airways, use of the two-person two-handed technique with a thenar grip, and optimal patient positioning, will usually result in effective ventilation (see Chapter 12). If reoxygenation efforts fail and oxygen saturations keep dropping despite the optimal technique, the airway is considered a CICO failed airway, and one must exit the main algorithm immediately and initiate the failed airway algorithm (Fig. 5.5). This is the most recognized definition of a failed airway. In a CICO failed airway, rescue strategies are begun immediately to prevent further desaturation and its sequelae, anoxic injury, or cardiac arrest. Recognition of the failed airway is crucial because delays caused by persistent, futile attempts at intubation will waste critical seconds or minutes and may sharply reduce the time remaining for a rescue technique to be successful before brain injury ensues.

Key question 5: Have two attempts at orotracheal intubation been made by an experienced operator?

In addition to CICO, there are two additional definitions of airway failure that need to be considered: (i) "two missed attempts by an experienced operator"; (ii) a missed *single best attempt* in the context of a "forced to act" scenario (described in the difficult airway algorithm section). If two separate attempts at orotracheal intubation by an experienced operator using the best available device have been unsuccessful, then the airway is also defined as a failed airway, despite the ability to adequately oxygenate the patient using a bag and mask. Data from the NEAR have shown that the majority (>95%) of all ED intubations are successful within two attempts. If an experienced operator has used the best available method of laryngoscopy, typically VL, for two attempts without success, the incremental benefit of a third try does not justify the risk of airway trauma, swelling, desaturation, and clinical deterioration that occurs with successive attempts. As a general rule, the operator should recognize the failed airway and manage it as such using the failed airway algorithm. If the first attempt was unsuccessful, but BMV is successful, then it is appropriate to attempt orotracheal intubation again, provided the oxygen saturation is maintained and the operator can identify an element of the laryngoscopy that can be improved and likely to lead to success (eg, use of a different device). Similarly, if the initial attempt was made by an inexperienced operator, such as a trainee, and the patient is adequately oxygenated, then it is appropriate to reattempt oral intubation until two attempts by the most experienced operator have been unsuccessful. If available, at least one of those attempts should be made with a video laryngoscope, and if the initial attempt failed using conventional laryngoscopy, we recommend switching to a video laryngoscope for the second attempt. This is not an absolute rule, however, and additional attempts at laryngoscopy may be appropriate before declaring a failed airway. This most often occurs when the operator identifies a particular strategy for success (eg, better control of the epiglottis by using a larger laryngoscope blade, switching to a video laryngoscope) during the second unsuccessful attempt. Similarly, it is possible that an *experienced* operator will recognize on the *very first attempt* that further attempts at orotracheal intubation will not be successful. In such cases, provided that the patient has been optimally positioned for intubation, good relaxation has been achieved, and it is the operator's judgment that further attempts at laryngoscopy would be futile, the airway should be immediately regarded as a failed airway, and the failed airway algorithm initiated. Thus, it is not essential to always make two laryngoscopic attempts before labeling an airway as failed, but two failed attempts by an experienced operator with optimal adjuncts should be considered a failed airway, unless the laryngoscopist identifies a particular problem and solution, justifying one more attempt.

THE CARDIAC ARREST AIRWAY ALGORITHM

Entering the cardiac arrest airway algorithm (Fig. 5.3) indicates that one has identified an agonal or coding patient with an immediate need for oxygenation and ventilation. In this algorithm, definitive airway management (ie, placement of a cuffed tube in the trachea) is superseded by overall resuscitation management and quality CPR. The goal of airway management is to provide oxygenation to allow return of cardiac activity and spontaneous circulation. High-quality BMV or the use of an EGD is the initial step in cardiac arrest airway management.

Key question 1: Is the patient agonal or pulseless?

Confirm the patient is either agonal, on the verge of arrest, or in full cardiopulmonary arrest. This will be evident by rapid bedside assessment of respirations and peripheral pulses.

Critical Action: Perform BMV or place an EGD

To align with advanced cardiac life support (ACLS) recommendations, initial airway management involves ventilation and oxygenation by either a bag and mask device or an EGD. The EGD used is not defined here and will be based primarily on availability and clinician comfort. An EGD that can facilitate either blind (eg, LMA Fastrach) or guided tracheal intubation via flexible endoscope (eg, i-gel, AirQ) is preferred.

Key question 2: Does ventilation seem to be successful?

This will be determined by a combination of the waveform capnography, ease of bagging, and visible chest excursion. Oxygen saturations cannot be relied upon during cardiac arrest. With BMV, if ventilation is inadequate or unsuccessful, ensure that oral and nasal airways are in place and a two-person, two-handed thenar grip technique is being used (see Chapter 12). If BMV is still unsuccessful, then insert an EGD and reattempt ventilation. Alternatively, an EGD can be placed as the first airway maneuver.

Critical Action: Attempt at Definitive Airway

If both BMV and EGD are deemed to be failing (ie, no capnogram trace, high resistance to bagging, no visible chest rise), then attempt definitive airway placement. This can typically be accomplished without the use of drugs. Most often, the initial attempt will be orotracheal intubation. If intubation fails, perform a cricothyrotomy. In rare circumstances, such as progressive upper airway edema, a cricothyrotomy may be the preferred first method for definitive airway placement if the clinician believes orotracheal intubation would be futile because of severe swelling. If definitive airway placement is successful, then proceed with ongoing code management.

Key question 3: Is there a need for intubation during the code?

Circumstances may arise during an active code that make tracheal intubation desirable or necessary. These include large volume emesis or active bleeding (for which airway protection against aspiration with a cuffed tracheal tube is required), a prolonged code, or the need for a specialized procedure such as a TEE.

Critical Action: Attempt at Definitive Airway

Attempt intubation as outlined in the previous step. If intubation is unsuccessful, perform a cricothyrotomy. If intubation is successful, proceed with ongoing code management.

Key question 4: Is there return of circulation?

A pulse check is performed after CPR and a round of code medications. If the patient remains pulseless, reevaluate ventilation via BMV or EGD and retrace your steps through the algorithm. This loop will continue until the code is either terminated or pulses return.

Critical Action: Move to Difficult Airway Algorithm

If circulation returns, one can move to the difficult airway algorithm to plan for definitive airway management. In the peri-arrest period, patients may be pressor-dependent and hemodynamically unstable. If this is the case, continue hemodynamic optimization (see Chapter 20) until the best hemodynamic environment is obtained, followed by careful drug selection and RSI.

THE DIFFICULT AIRWAY ALGORITHM

Identification of the anatomically and physiologically difficult airway is discussed in detail in Chapters 2 and 3. This algorithm (Fig. 5.4) represents the clinical approach that should be used in the event of an identified potential difficult airway.

Critical Action: Call for Assistance

The "call for assistance" box is linked as a dotted line because this is an optional step, dependent on the clinical circumstances, skill of the airway manager, available equipment and resources, and availability of additional personnel.

Key question 1: Is the operator forced to act?

In some circumstances, although the airway is identified to be difficult, patient conditions force the operator to act immediately, before there is rapid deterioration of the patient into respiratory arrest. An example of this situation is given earlier in this chapter. Another example is a patient with rapidly progressive anaphylaxis from a contrast reaction while getting a computed tomography (CT) scan. The patient is anxious, agitated, and in severe distress. In such cases, there may not be time to obtain and administer epinephrine or antihistamines and reassess for improvement before total airway obstruction occurs. In such circumstances, dynamic airway deterioration is occurring so rapidly that a prompt decision to give RSI drugs and create circumstances for a *best single attempt* at tracheal intubation, whether by laryngoscopy or surgical airway, is preferable to medical management alone and hoping for immediate reversal as the patient progresses to complete airway obstruction, respiratory arrest, and death. Administration of RSI drugs will optimize the operator's ability to intubate, perform a surgical airway, place an EGD, or use a bag and mask to oxygenate the patient. The key is for the operator to make the *one* best attempt that, in the operator's judgment, is most likely to succeed. If the attempt is successful, then the operator proceeds to PIM. If that one attempt is not successful, a failed airway is present, and the operator proceeds to the failed airway algorithm.

Key question 2: Are oxygen saturations dropping?

In the context of the difficult airway, *oxygen is time*. If preoxygenation efforts (see Chapter 20) result in stable, adequate oxygen saturations at or above 94%, then a careful assessment and a methodical, planned approach can be undertaken, even if significant preparation time is required. If oxygen saturations are dropping and cannot be stabilized, immediately move to the failed airway algorithm. This situation is equivalent to a "can't intubate (the identified difficult airway is a surrogate for can't intubate), can't oxygenate (adequate oxygen saturation cannot be maintained)" failed airway. Certain difficult airway patients will have chronic pulmonary disease, for example, and may not be able to reach an oxygen saturation of 93%, but can be kept stable and viable at, say, 89%. Additionally, a patient may have been considered difficult because of a cervical collar placed by emergency medical services (EMS) after an isolated head injury, but the suspicion for cervical spine injury is low and there are no other markers of airway difficulty. In this example, an experienced airway manager, armed with a video laryngoscope, may not consider this situation analogous to a "can't intubate" scenario. In other words, whether to call these cases failed airways is a matter of judgment considering both the degree of oxygen debt and the severity of predicted difficulty. If a decision is made to proceed down the difficult airway algorithm rather than switching to the failed airway algorithm, it is essential to be aware desaturation may occur rapidly during intubation attempts and a final judgment about the appropriateness of RSI versus an awake technique still needs to be made.

Key question 3: Should I use an NMBA on this patient?

Is rescue oxygenation using a bag and mask or EGD predicted to be successful? Is rapid desaturation anticipated? Is laryngoscopy predicted to be successful? Having a patient in the difficult airway algorithm does not obviate RSI. In fact, in most cases, RSI remains the best approach despite the presence of airway difficulty. This decision hinges, primarily, on the degree of predicted difficult laryngoscopy, the safe apnea time, and the likelihood of successful rescue reoxygenation should the patient desaturate. There are three key factors combined into one composite "yes or no" question.

The first, and most important, factor is whether one predicts with confidence that gas exchange can be maintained by BMV or the use of an EGD if RSI drugs are administered rendering the patient paralyzed and apneic. This answer may already be known whether BMV has been required to maintain the patient's oxygenation or whether the difficult airway evaluation did not identify difficulty for oxygenation using BMV or an EGD. Anticipating successful oxygenation using BMV or an EGD is an essential prerequisite for RSI, except in the "forced to act" situation described earlier. In some cases, it may be desirable to attempt a trial of BMV, but this approach does not reliably predict the ability to bag-mask ventilate the patient after paralysis. Second, what is the anticipated risk of critical hypoxemia caused by rapid desaturation before laryngoscopy can begin? After administration of RSI medications, the patient will become significantly hypopneic from the induction agent. This will occur well before full neuromuscular blockade is complete. As a result, exceptionally high-risk patients (eg, an obese patient with COVID-19 and hypoxemic respiratory failure) may dangerously desaturate before conditions exist to permit an intubation attempt. In these situations, even when laryngoscopy is expected to be straightforward, successful tube placement and reoxygenation may not occur before cardiac arrest ensues. If BMV or EGD use is anticipated to be successful and rapid desaturation risk is not high, then the next consideration is whether laryngoscopy and intubation is likely to be successful, despite the difficult airway attributes. Many patients with identified difficult airways undergo successful emergency intubation employing RSI, particularly when a video laryngoscope is used. So, if there is a reasonable likelihood of success with oral intubation, *despite predicting a difficult airway*, RSI may be undertaken. Remember, this is predicated on the fact that one has already judged that gas exchange (BMV or EGD) will be successful and oxygen saturations can be maintained long enough to permit a laryngoscopic attempt.

In these cases, RSI is performed using a "double setup," in which the rescue plan (often cricothyrotomy) is clearly established, and the operator is prepared to move promptly to the rescue technique if intubation using RSI is not successful (failed airway). Given the high rate of difficult emergency intubation, it is prudent to *always* prepare for airway failure, including the possibility of surgical rescue, even when intubation is expected to be straightforward. Therefore, when RSI is undertaken despite identification of difficult airway attributes, appropriate care during the technique and planning related to the particular difficulties present will result in success.

To reiterate these fundamental principles, if gas exchange employing BMV or EGD is not confidently assured of success, the risk of critical desaturation before tracheal tube placement is high, or laryngoscopy is felt to be very challenging or impossible, then RSI is not recommended. The only exception to this is in the "forced to act" scenario.

Critical Action: Perform "Awake" Laryngoscopy

Just as RSI is an essential technique of emergency airway management, "awake" intubation is the cornerstone of difficult airway management. The primary goal of this maneuver is to intubate the patient comfortably, while maintaining spontaneous respirations. This technique requires thorough topicalization of the airway and, sometimes, the judicious use of sedation in order to permit laryngoscopy (see Chapter 24). The principle here is that the patient is awake enough to maintain protective airway reflexes and effective spontaneous ventilation but is sufficiently anesthetized to tolerate an awake instrumentation of the airway. The laryngoscopy can be done orally with a flexible, video or direct laryngoscope or nasally with a flexible scope. Awake VL is preferred because the depth of blade insertion and force required to get an adequate view of the glottic inlet is less than that required with a conventional laryngoscope. These devices are discussed in detail in Chapter 16. Two outcomes are possible from this awake examination. First, the glottis is adequately visualized. In this situation, proceed with intubation. It could be tempting to withdraw, feeling confident that the airway can be visualized, and begin anew with RSI. Although this is a reasonable thought, subsequent laryngoscopy could prove more difficult, even with neuromuscular blockade. Therefore, we recommend completing the intubation during the awake look, provided the glottis is sufficiently visualized to permit intubation. The second possible outcome during the awake laryngoscopic examination is that the glottis is not adequately visualized to permit intubation. In this case, the examination has confirmed the suspected difficult intubation and reinforced the decision to avoid neuromuscular paralysis. A failed airway has been avoided, and several options remain. Maintain oxygenation, as necessary, at this point.

Critical Action: Select an Alternative Airway Approach

At this point, we have clarified that we have a patient with difficult airway attributes, who has proven to be a poor candidate for laryngoscopy, and therefore is inappropriate for RSI. If oxygenation is maintained, there are several options available. If the awake orotracheal laryngoscopy was done using a direct laryngoscope, a video laryngoscope or flexible scope will likely provide a superior view of the glottis. Given the visualization advantage offered by VL, it should be considered a first-line device for awake orotracheal laryngoscopy. The main fallback method for the difficult airway is cricothyrotomy, although the airway may be amenable to an EGD that facilitates intubation, that is, one of the intubating LMAs (LMA Fastrach). In highly select cases, blind nasotracheal intubation may be possible but requires an anatomically normal upper airway. In general, blind nasotracheal intubation is used only when a flexible scope is not available or when there is excessive bleeding in the airway. The choice of technique will depend on the operator's experience, available equipment, the difficult airway attributes the patient possesses, and the urgency of the intubation. Irrespective of the technique used, the goal of difficult airway management is to place a cuffed ETT in the trachea. If oxygenation cannot be maintained, then the failed airway algorithm is invoked.

THE FAILED AIRWAY ALGORITHM

At several points in the preceding algorithms, it may be determined that airway management has failed. The definition of the failed airway (see previous discussion in this chapter and in Chapter 4) is based on one of three criteria being satisfied, the first being paramount: (i) a failure of any intubation attempt in a patient for whom oxygenation cannot be adequately maintained with a bag and mask or EGD, (ii) two unsuccessful intubation attempts by an experienced operator but with adequate oxygenation, and (iii) missed intubation using the one *best attempt* in the "forced to act" situation. Unlike the difficult airway, where the standard of care dictates the placement of a cuffed ETT in the trachea providing a definitive, protected airway, the failed airway calls for action to provide emergency oxygenation sufficient to prevent patient morbidity (especially hypoxic brain injury and cardiac arrest) by whatever means possible, until a definitive airway can be secured (Fig. 5.5). Thus, the devices considered for the failed airway are somewhat different from, but inclusive of, the devices used for the difficult airway. When a failed airway has been determined to occur, the response is guided by whether oxygenation is possible.

Critical Action: Call for Assistance

As is the case with the difficult airway, it is best to call for any available and necessary assistance as soon as a failed airway is identified. Again, this action may be a stat consult to emergency medicine, anesthesia, or surgery, or it may be a call for special equipment. In the prehospital setting, a second paramedic or a medical control physician might provide assistance.

Key question 1: Is oxygenation adequate?

As is the case for the difficult airway, this question addresses the time available for a rescue airway. If the patient is a failed airway because of two failed attempts by an experienced operator, in most cases, oxygen saturation will be adequate, and there is time to consider various approaches. If, however, the failed airway is because of a CICO situation, then there is little time left before brain hypoxia ensues, and immediate action is indicated. Many, or most, CICO patients will require surgical airway management, and preparation for a surgical airway should be undertaken. It is reasonable, as the first rescue step, to make a single attempt to insert a rapidly placed extraglottic airway device, *simultaneously with the preparation for a cricothyrotomy.* Placement or even use of an EGD does not preclude a surgical airway should that device fail, yet successful oxygenation using the EGD converts the CICO situation into a *can't* intubate, *can* oxygenate situation, allowing time for consideration of several different approaches to securing the airway.

Achieve an airway using a flexible scope, a video laryngoscope, an EGD, or with a cricothyrotomy. In the can't intubate, *can* oxygenate situation, various devices are available to provide an airway, and most also provide some degree of airway protection. Intubation with a flexible or video laryngoscope will establish a cuffed tube in the trachea. Of the EGDs, the intubating laryngeal mask airways (ILMAs) are preferable because they have a high likelihood of providing effective ventilation and usually permit intubation through the device either blindly or guided by a flexible endoscope (see Chapters 13 and 17). Cricothyrotomy always remains the final common pathway if other measures are not successful, or if the patient's oxygenation becomes compromised.

Key question 2: Does the device used result in a definitive airway?

If the device used results in a definitive airway (ie, a cuffed ETT in the trachea), then one can move on to PIM. If an EGD has been used, or intubation was not successful through the EGD, arrangements must be made to provide a definitive airway. A definitive airway may be provided in the operating room, ICU, or ED, once the necessary personnel and equipment are available. Until then, constant surveillance is required to ensure that the airway, as placed, continues to provide adequate oxygenation, with cricothyrotomy always available as a backup.

SUMMARY

These algorithms represent our most current thinking regarding a recommended approach to emergency airway management. The algorithms are intended as guidelines only. Individual decision-making, clinical circumstances, skill of the operator, and available resources will determine the final, best approach to airway management in any individual case. Understanding the fundamental concepts of the difficult and failed airway, identification, in advance, of the difficult airway, understanding the role of airway management in cardiac arrest, and the use of RSI, after physiologic optimization, as the airway management method of choice for most emergency intubations will foster successful airway management while minimizing preventable morbidity.

EVIDENCE

Evidence for the algorithms

Unfortunately, there are no systematized data supporting the algorithmic approach presented in this chapter. The algorithms are the result of careful review of the American Society of Anesthesiologists difficult airway algorithm, the algorithms of the Difficult Airway Society of the United Kingdom, and composite knowledge and experience of the editors and faculty of The Difficult Airway Courses, who function as an expert panel in this regard.[1,2] There has not been, and likely never will be, a study comparing, for example, the outcomes of cricothyrotomy versus alternate airway devices in the CICO situation. Clearly, randomization of such patients is not ethical. Thus, the algorithms are derived from a comprehensive body of knowledge and represent a recommended approach but cannot be considered to be scientifically proven as the best way to approach any one clinical problem or patient. Rather, they are designed to help guide a consistent approach to both common and uncommon airway management situations. The evidence for the superiority of RSI over other methods not involving neuromuscular blockade and the performance characteristics of video versus direct laryngoscopy can be found in Chapters 20 and 16, respectively.

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