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The Decision to Intubate

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2 ● SECTION I PRINCIPLES OF AIRWAY MANAGEMENT

Timely, effective airway management in an emergency can mean the difference between life and death, or between ability and disability. As such, airway management is the single most important skill of the emergency physician, and emergency airway management is one of the defining domains of the specialty of emergency medicine. Anesthesia providers, hospitalists, and intensivists often are called upon as the primary responders to airway emergencies arising in hospital inpatient units. Paramedics and critical care transport personnel are responsible for the out-of-hospital airway. Regardless of specialty or locus of care, these practitioners must maintain the cognitive base and technical skill set required for swift, decisive airway management, which is often required without warning and in suboptimal circumstances.

The emergence of new technology, principally the various methods of video laryngoscopy, is changing the fundamental approach to airway decision-making, particularly with respect to difficult intubation. Nevertheless, emergency airway management, whether in the emergency department (ED) or elsewhere in the hospital or prehospital setting, still comprises a series of complex actions:

- Rapidly assess the patient's need for intubation and the urgency of the situation.
- Determine the best method of airway management.
- Decide whether pharmacologic agents are indicated, which to use, in what order, and in what doses.
- Construct a plan in the event that the primary method is unsuccessful; recognize when the planned airway intervention has failed, and quickly and effectively execute the alternative (rescue) technique.

Physicians responsible for emergency airway management must be proficient with the techniques and medications used for rapid sequence intubation, the preferred method for most emergency intubations. The entire repertoire of airway skills must be mastered, including bag-mask ventilation, conventional and video laryngoscopy, flexible endoscopy, the use of extraglottic airway devices, adjunctive techniques such as use of an endotracheal tube introducer (ETI, EI; also known as the gum elastic bougie), and surgical airway techniques (e.g., cricothyrotomy).

This chapter focuses on the decision to intubate. Subsequent chapters describe airway management decision-making, methods of ensuring oxygenation, techniques and devices for airway management, the pharmacology of airway management, and considerations for certain special clinical circumstances, including the prehospital environment and care of pediatric patients.

INDICATIONS FOR INTUBATION

The decision to intubate is based on three fundamental clinical assessments:

1. Is there a failure of airway maintenance or protection?
2. Is there a failure of ventilation or oxygenation?
3. What is the anticipated clinical course?

The results of these three evaluations will lead to a correct decision to intubate or not to intubate in virtually all conceivable cases.

A. *Is there a failure of airway maintenance or protection?*

A patent airway is essential for adequate oxygenation and ventilation, and protection of the airway against aspiration of gastric contents is vital. The conscious, alert patient uses the musculature of the upper airway and various protective reflexes to maintain a patent airway and to protect against the aspiration of foreign substances, gastric contents, or secretions. The ability of the patient to phonate with a clear, unobstructed voice is strong evidence of both airway patency and protection. In the severely ill or injured patient, such airway maintenance and protection mechanisms are often attenuated or lost. If the spontaneously breathing patient is

not able to maintain a patent airway, an artificial airway may be established by the insertion of an oropharyngeal airway or a nasopharyngeal airway. Although such airway devices may restore a patent airway, they do not provide any protection against aspiration. As a general rule, any patient who requires the establishment of a patent airway also requires protection of that airway, and the use of an oropharyngeal or nasopharyngeal airway should be considered a temporizing measure, pending establishment of a definitive airway: placement of an appropriate (cuffed for adults and uncuffed for small children) endotracheal tube in the trachea.

A patient who is seemingly able to maintain a patent airway and adequate gas exchange cannot be assumed to be able to protect the airway against the aspiration of gastric contents, which carries a significantly increased risk of morbidity and mortality. It has been widely taught that the gag reflex is a reliable method of evaluating airway protective reflexes. In fact, this concept has never been subjected to adequate scientific scrutiny, and the absence of a gag reflex is neither sensitive nor specific as an indicator of loss of airway protective reflexes. The presence of a gag reflex has similarly not been demonstrated to ensure the presence of airway protection. In addition, testing the gag reflex in a supine, obtunded patient may result in vomiting and possible aspiration. Accordingly, the gag reflex is of no clinical value when assessing the need for intubation and should not be used for this purpose.

The assessment of spontaneous or volitional swallowing is probably a better assessment of the patient's ability to protect the airway than is the presence or absence of a gag reflex. Swallowing is a complex reflex that requires the patient to sense the presence of material in the posterior oropharynx and then to execute a series of intricate and coordinated muscular actions to direct the secretions down past a closed airway into the esophagus. The finding of pooled secretions in the patient's posterior oropharynx indicates a potential failure of these protective mechanisms, hence a failure of airway protection. In the absence of an immediately reversible condition, such as opioid overdose or reversible cardiac dysrhythmia, prompt intubation is indicated for any patient who is unable to maintain and protect the airway. A common clinical error is to assume that spontaneous breathing is proof that the ability to protect the airway is preserved. Although spontaneous ventilation may be adequate, the patient may be sufficiently obtunded to be at serious risk of aspiration.

B. *Is there a failure of ventilation or oxygenation?*

Stated simply, "gas exchange" is adequate to sustain vital organ function. If the patient is unable to ventilate adequately, or if adequate oxygenation cannot be achieved despite the use of supplemental oxygen, then intubation is indicated. In such cases, the intubation is performed to facilitate ventilation and oxygenation rather than to establish or protect the airway. An example is the patient with status asthmaticus, for whom bronchospasm and fatigue lead to ventilatory failure and hypoxemia, heralding respiratory arrest and death. Airway intervention is indicated when it is determined that the patient will not respond sufficiently to treatment to reverse the cascading events leading to respiratory arrest. Similarly, although the patient with severe acute respiratory distress syndrome may be maintaining and protecting the airway, he or she may have progressive oxygenation failure and supervening fatigue that can be managed only with tracheal intubation and positive-pressure ventilation. Unless ventilatory or oxygenation failure is resulting from a rapidly reversible cause, such as opioid overdose, intubation is required.

C. *What is the anticipated clinical course?*

Most patients who require emergency intubation have one or more of the previously discussed indications: failure of airway maintenance, airway protection, oxygenation, or ventilation. However, there is a large and important group for whom intubation is indicated, even though none of these four fundamental failures is present at the time of evaluation. These are the patients whose conditions, and airways, are predicted to deteriorate, either because of dynamic and progressive changes related to the presenting condition or because the work of breathing will become overwhelming in the face of catastrophic illness or injury. For example, consider the patient who presents with a stab wound to the midzone of the anterior neck and a visible hematoma. At the time of presentation, the patient may have perfectly adequate airway maintenance and protection and be ventilating and oxygenating well. The hematoma, however, provides clear evidence of significant vascular injury. Ongoing bleeding may be clinically

occult because the blood often tracks down the tissue planes of the neck (e.g., prevertebral space) rather than demonstrating visible expansion of the hematoma. Furthermore, the anatomical distortion caused by the enlarging internal hematoma may well thwart a variety of airway management techniques that would have been successful if undertaken earlier. The patient inexorably progresses from awake and alert with a patent airway to a state in which the airway becomes obstructed, often quite suddenly, and the anatomy is so distorted that airway management is difficult or impossible.

Analogous considerations apply to the polytrauma patient who presents with hypotension and multiple severe injuries, such as chest trauma. Although this patient initially maintains and protects his airway, and ventilation and oxygenation are adequate, intubation is indicated as part of the management of the constellation of injuries (i.e., as part of the overall management of the patient). The reason for the intubation of such patients becomes clear when one examines the anticipated clinical course of this patient. The hypotension mandates fluid resuscitation and evaluation for the source of the blood loss, including likely abdominal CT scan. Pelvic fractures, if unstable, require immobilization and likely embolization of bleeding vessels. Long bone fractures often require operative intervention. Chest tubes may be required to treat hemopneumothorax or in preparation for positive-pressure ventilation during surgery. Combative behavior confounds efforts to maintain spine precautions and requires pharmacologic restraint and evaluation by head CT scan. Throughout all of this, the patient's shock state causes inadequate tissue perfusion and increasing metabolic debt. This debt significantly affects the muscles of respiration, and progressive respiratory fatigue and failure often supervene. With the patient's ultimate destination certain to be the operating room or the ICU, and the need for complex and potentially painful procedures and diagnostic evaluations, which may require extended periods of time outside the resuscitation suite, this patient is best served by early intubation. In addition, intubation improves tissue oxygenation during shock and helps reduce the increasing metabolic debt burden.

Sometimes, the anticipated clinical course may be such that intubation is mandated because the patient will be exposed to a period of increased risk. For example, the patient with multiple injuries who appears relatively stable might be appropriately managed without intubation while geographically located in the ED. However, if that same patient requires CT scans, angiography, or any other prolonged diagnostic procedure, it may be more appropriate to intubate the patient before allowing him or her to leave the ED so that an airway crisis will not ensue in the radiology suite, where recognition may be delayed and response may not be optimal. Similarly, if such a patient is to be transferred from one hospital to another, airway management may be indicated on the basis of the increased risk to the patient during that transfer.

Not every trauma patient or every patient with a serious medical disorder requires intubation. However, in general, it is better to err on the side of caution by performing an intubation that might not, in retrospect, have been required, than to delay intubation, thus exposing the patient to a potentially disastrous deterioration.

APPROACH TO THE PATIENT

When evaluating a patient for emergency airway management, the first assessment should be of the patency and adequacy of the airway. In many cases, the adequacy of the airway is confirmed by having the patient speak. Ask questions such as "What is your name?" or "Do you know where you are?" The responses provide information about both the airway and the patient's neurologic status. A normal voice (as opposed to a muffled or distorted voice), the ability to inhale and exhale in the modulated manner required for speech, and the ability to comprehend the question and follow instructions are strong evidence of adequate upper airway function. Although such an evaluation should not be taken as proof that the upper airway is definitively secure, it is strongly suggestive that the airway is adequate *for the time being*. More importantly, the inability of the patient to phonate properly, inability to swallow secretions, or the presence of stridor, dyspnea, or altered mental status

BOX 1-1. Four Key Signs of Upper Airway Obstruction

- Muffled or “Hot Potato” voice (as though the patient is speaking with a mouthful of hot food)
- Inability to swallow secretions, either because of pain or obstruction
- Stridor
- Dyspnea

The first two signs do not necessarily herald imminent total upper airway obstruction; stridor, if new or progressive, usually does, and dyspnea also is a compelling symptom.

precluding responses to the questions should prompt a detailed assessment of the adequacy of the airway and ventilation (see Box 1-1). After assessing verbal response to questions, conduct a more detailed examination of the mouth and oropharynx. Examine the mouth for bleeding, swelling of the tongue or uvula, abnormalities of the oropharynx (e.g., peritonsillar abscess), or any other abnormalities that might interfere with the unimpeded passage of air through the mouth and oropharynx. Examine the mandible and central face for integrity. Examination of the anterior neck requires both visual inspection for deformity, asymmetry, or abnormality and palpation of the anterior neck, including the larynx and trachea. During palpation, assess carefully for the presence of subcutaneous air. This is identified by a crackling feeling on compression of the cutaneous tissues of the neck, much as if a sheet of wrinkled tissue paper were lying immediately beneath the skin. The presence of subcutaneous air indicates disruption of an air-filled passage, often the airway itself, especially in the setting of blunt or penetrating chest or neck trauma. Subcutaneous air in the neck also can be caused by pulmonary injury, esophageal rupture, or, rarely, gas-forming infection. Although these latter two conditions are not immediately threatening to the airway, patients may nevertheless rapidly deteriorate, requiring subsequent airway management. In the setting of blunt anterior neck trauma, assess the larynx for pain on motion. Move the larynx from side to side, assessing for “laryngeal crepitus,” indicating normal contact of the airway with the airfilled upper esophagus. Absence of crepitus may be caused by edema between the larynx and the upper esophagus.

After inspecting and palpating the upper airway, note the respiratory pattern of the patient. The presence of inspiratory stridor, however slight, indicates some degree of upper airway obstruction. Lower airway obstruction, occurring beyond the level of the glottis, more often produces expiratory stridor. The volume and pitch of stridor are related to the velocity and turbulence of the ventilatory airflow. Most often, stridor is audible without a stethoscope. Auscultation of the neck with a stethoscope can reveal subauditory stridor that may also indicate potential airway compromise. Stridor is a late sign, especially in adult patients, who have large diameter airways, and significant airway compromise may develop before any sign of stridor is evident. When evaluating the respiratory pattern, observe the chest through several respiratory cycles. Symmetrical, concordant chest movement is the expected finding. In cases where there is significant injury, paradoxical movement of a flail segment of the chest may be observed. If spinal cord injury has impaired intercostal muscle functioning, diaphragmatic breathing may be present. In this form of breathing, there is little movement of the chest wall, and inspiration is evidenced by apparent increase in abdominal volume caused by descent of the diaphragm. Auscultate the chest to assess the adequacy of air exchange. Decreased breath sounds indicated pneumothorax, hemothorax, pleural effusion, or other pulmonary pathology.

The assessment of ventilation and oxygenation is a clinical one. Arterial blood gas determination provides little additional information as to whether intubation is necessary and may be misleading. The clinical impression of the patient’s mentation, degree of fatigue, and severity of concomitant injuries or conditions is more important than isolated or even serial determinations of arterial oxygen or carbon dioxide (CO₂) tension. Oxygen saturation is monitored continuously by pulse oximetry, so arterial blood gases rarely are indicated for the purpose of determining arterial

oxygen tension. In certain circumstances, oxygen saturation monitoring is unreliable because of poor peripheral perfusion, and arterial blood gases may then be required to assess oxygenation or to provide a correlation with pulse oximetry measurements. Continuous capnography (see Chapter 8) may be used to assess changes in the patient's ability to ventilate adequately, and the measurement of arterial CO₂ tension contributes little additional useful information, although often a single arterial blood gas measurement is used to provide a correlation baseline with end-tidal CO₂ readings. In patients with obstructive lung disease, such as asthma or chronic obstructive pulmonary disease, intubation may be required in the face of relatively low CO₂ tensions if the patient is becoming fatigued. Other times, extremely high CO₂ tensions may be managed successfully without intubation if the patient is showing clinical signs of improvement (e.g., increased alertness, improving speech, and less fatigue).

Finally, after assessment of the upper airway and the patient's ventilatory status, including pulse oximetry, capnography (if used), and mentation, consider the patient's anticipated clinical course. If the patient's condition is such that intubation is inevitable and a series of interventions is required, early intubation is preferable. Similarly, if the patient has a condition that is at risk of worsening over time, especially if it is likely to compromise the airway itself, early airway management is indicated. The same consideration applies to patients who require interfacility transfer by air or ground or a prolonged procedure in an area with diminished resuscitation capability. Intubation before transfer is preferable to a difficult, uncontrolled intubation in an austere environment after the condition has worsened. In all circumstances, the decision to intubate should be given precedence. If doubt exists as to whether the patient requires intubation, err on the side of intubating the patient. It is preferable to intubate the patient and ensure the integrity of the airway than to leave the patient without a secure airway and have a preventable crisis occur.

EVIDENCE

- **Is the gag reflex a useful indicator of the need to intubate?** Although it persists, inexplicably, in clinical practice, the gag reflex largely has disappeared from research evaluations, except with respect to whether it relates to the development of aspiration in overdose patients.¹ In a study of 111 patients requiring neurologic observation in the ED, Moulton et al.² found no correlation between the Glasgow Coma Scale (GCS) and the presence or absence of a gag reflex. The gag reflex was noted to be variably present across the range of GCS from 6 to 15, independent of the patient's perceived need for intubation.² The gag reflex is not involved in laryngeal closure or protection of the airway. Bleach³ found an absent gag reflex in 27% of fully conscious patients who had undergone speech therapy and videofluoroscopy to assess for possible aspiration after neurologic events. There was no correlation between aspiration and the presence (or absence) of the gag reflex.³ Davies et al.⁴ studied 140 healthy adults, half of whom were elderly, and found that 37% lacked any gag reflex. Chan et al.⁵ studied 414 patients with acute poisoning and noted absence of the gag reflex to be only 70% sensitive in identifying patients who required intubation. In one small study, all patients who required intubation had an absent gag reflex; however, the use of a GCS score of 8 or less outperformed the gag reflex, and evaluation of the gag reflex added nothing to the assessment of the GCS score alone.⁵

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