Emergent Airway Management

Achieving control of the airway and establishing effective ventilation is a critical procedure and can be lifesaving. One of the most stressful circumstances for Respiratory Therapists and Physicians. Our goal is to provide fundamental knowledge and techniques for management of the difficult airway.

ABC’s of Airway Management

- Establishing a patent airway with effective ventilation is the starting point of resuscitation.
- How do we start?
  - Call for competent assistance.
  - Promptly assess pt.’s current illness and history.
  - Perform physical examination in preparation for airway management.

Promptly assess pt.’s current illness and history.

- Aspects of the pt.’s medical history will influence your decision and choice of airway control.
- Current medication and drug allergies must be elicited from:
  - Patient
  - Medical Records
  - Healthcare providers in attendance
  - Family members

Medical conditions influencing airway management

- Cardiac Disease
  - Myocardial Ischemia
  - Congestive Failure / Pulmonary Edema
  - Valvular malfunction with accompanying hypotension
  - Hypovolemia

- Respiratory Tract
  - Reactive Airways
  - Obstructive Disease
  - Restrictive Disease
Neuromuscular Weakness

- Strong risk of hyperkalemia, therefore you should consider nondepolarizing neuromuscular blocker.

Head Trauma

- Risk of increased intracranial pressure with depolarizing neuromuscular blocker (DNMB) such as succinylcholine.

Renal Insufficiency

- Significant risk of DNMB induced hyperkalemia and prolonged effect of administered medications.
- Consider non-depolarizing, non-renalley cleared neuromuscular blocker.

Gastroesophageal Reflux

- Recent food or fluid intake.
- Both of these situations may require rapid sequence intubation with cricoid pressure or possible awake intubation.

Upper Airway Disease

- Mass or Deformity
  - Expect and plan for a difficult intubation.
  - Call for competent assistance early!
- Obstructive Sleep Apnea
- Prior History of Difficult Intubation

Crani-Cervical Trauma

- Possibility of unstable jaw or cervical spine.
  - Call for assistance
  - Consider intubation with stabilization
  - Use of fiberoptic devices may greatly improve outcomes.

Following the initial assessment and primary survey, physical examination should include a directed evaluation of the upper airway to determine route and method of intubation.
Physical examination of the upper airway will determine:

- Route
  - Oral
  - Nasal
  - Transtracheal

- Method
  - Awake
  - Anesthetized

Examination Components:

- Mouth Opening
- Tongue vs Pharyngeal Size
- Atlanto-occipital joint extension
- Anterior Mandibular Space
- Mandibular Protrusion
- Dental Examination


Mouth Opening:

- ≥ 4 centimeters
  - Two fingers

Tongue vs Pharyngeal Size:

- Mallampati Class I or II

Atlanto-occipital joint extension:

- Extension > 35 degrees

Anterior Mandibular Space:

- Thyromental distance ≥ 6 centimeters
  - Four fingers


Mandibular Protrusion

- Protrusion of the lower teeth beyond the upper incisors.


Dental Examination

- No loose or damaged teeth or prostheses.
- Consider not removing false teeth during bag mask ventilation.

Wilson et al, Predicting Difficult Intubation. 1988

- Studied a combination of the above factors in a surgical population.
- Assigned scores based on mouth opening, neck extension, protuberant teeth and lower jaw protrusion.
- Successfully predicted difficult intubations, although also produced a high incidence of false positives.


Bag Mask Ventilation and Oxygenation

- Most critical skill in management of the airway is the ability to provide adequate ventilation with a soft seal mask and bag reservoir connected to high flow oxygen.

Skill most misunderstood by healthcare providers.

Height of the pt. should be adjusted so that the face is at the level of the HCP’s xiphoid process.

Pt. semi recumbent or supine.
- Head extended at the atlanto-occipital joint.
- Head tilt / jaw thrust maneuver.

Bag Mask Ventilation and Oxygenation
**Bag Mask Ventilation and Oxygenation**

- If pt. obtunded or sedated, use of an oral or naso pharyngeal airway may be required to relieve upper airway obstruction.

**Adequacy of ventilation judged by:**
- Bilateral breath sounds on auscultation
- Chest rise and fall
- Regular wave form on exhalation if End tidal Carbon Dioxide available (Etco₂)

**Ventilate and oxygenate pt. for 1-2 minutes before proceeding to direct laryngoscopy.**

**Pulse oximetry should confirm oxygen saturation of 100%.**

**If, despite proper positioning, adequate ventilation and oxygenation can not be achieved, the HCP should be prepared to proceed immediately to direct laryngoscopy.**

**Preparation for Endotracheal Intubation**

- Must ensure that the proper tools are available
  - Most adult tracheas can accept ET tube with an internal diameter of 7.0 – 9.0 mm.
  - The next size smaller size ET tube should always be prepared and available to the HCP.
  - Cuff should be inflated, checked for leaks and deflated prior to use.
  - Use malleable stylette (Hockey Stick)

**Which Laryngoscope Blade Do I Use????**

- Miller Advantages
  - Better exposure of glottus
  - Reduced trauma to upper teeth

**The one that will get the endotracheal tube safely into the trachea**
Preparation for Endotracheal Intubation

- Which Laryngoscope Blade Do I Use???

**Macintosh Advantages**
- Increased space in the pharynx for tube introduction.
- Reduced trauma to the lower teeth.
- Reduced trauma to the epiglottis.

Sedation and Neuromuscular Relaxation

- Once effective ventilation and pre-oxygenation assured, appropriate sedation should be administered.
- Primary goal is to facilitate rapid and atraumatic placement of the airway.
- Sedative and neuromuscular blockers are generally not indicated in cardiac arrest or pt.'s with no physiologic resistance to laryngoscopy.

Benzodiazepines

- Sedative-hypnotic agents that act as indirect gamma-aminobutyric acid (GABA) agonists.
- Relative rapid onset and relatively short duration of action.
- Midazolam (Versed) is usually the Benzodiazepine of choice.

Midazolam

- Most rapid onset of all the benzodiazepines, but it falls far short in this category compared with other classes of induction agents.
- 0.1-0.2 mg/kg IV, produces sedation within 1-2 minutes.
- Somewhat cerebroprotective in the patient with elevated ICP.
- A negative inotrope, midazolam should be used with caution in the presence of hypotension or suspected blood loss.

Etomidate

- Ultrashort-acting (30 sec) nonbarbiturate hypnotic agent though it lacks analgesic properties.
- Decreases cerebral oxygen consumption by 45% and cerebral blood flow by 34%, without affecting cerebral perfusion pressure.
- 0.2-0.3 mg/kg IV used for induction, 20 mg adult dose.
- The ability to protect ICP while simultaneously preserving BP makes etomidate an ideal choice for the unstable patient with head trauma.

Sedation

- Both Midazolam and Etomidate may cause apnea with in 10-15 seconds of administration at appropriate doses.
- Imperative that adequate ventilation is provide with their administration.
**Ketamine**

- Phencyclidine (PCP) derivative
- Ideal induction agent for RSI because it produces rapid sedation, has a brief duration of action, and is extremely potent.
- Dose for induction is 2 mg/kg IV with clinical recovery in 10-15 minutes
- Agent of choice in patients with bronchospasm because of its bronchodilator properties.

**Ketamine**

- Increase in blood pressure, heart rate, cardiac output, and an overall decrease in myocardial oxygen consumption.
- Only real clinical concern for its use in RSI is its inherent property of a potent cerebral dilator.
- Tendency to produce postanesthesia hallucinations (emergence phenomena).

**Ketamine**

- Meets many criteria for being an ideal induction agent in RSI.
- Patient that presents in status asthmaticus benefits from its bronchodilatory effects, as do patients in various degrees of shock with an absence of suspected ICP abnormality.

**Neuromuscular Blocking Agents**

- Should not be given to facilitate intubation unless the HCP is confident from the findings of the examination that intubation will be successful.
- Neuromuscular blockers should always be administered with adequate sedation.

**Neuromuscular Blocking Agents**

- Succinylcholine chloride
- Rocuronium
- Vecuronium

**Succinylcholine**

- Introduced in 1949 and has passed the test of time.
- Only depolarizing agent used for RSI.
- Due to its rapid onset, ultrashort duration of action, and safety, it is the paralytic of choice in almost all cases of RSI in adults.
**Succinylcholine**

- Dosage is 1.5 mg/kg in adults and 2.0 mg/kg in children younger than 5 years.
- Muscle relaxation occurs in just 30 seconds, with total paralysis in 45 seconds.
- Duration of action is short, lasting 7-10 minutes.

Adverse effects associated with the use of succinylcholine must be understood in order to anticipate the occasional, but severe, complications associated with its use.

- May increase serum potassium levels by 0.0-0.5 mEq/L.
- Burns over large surface area.
- Multisystem trauma with crush injury.
- Spinal cord and other denervating injuries.
- Any preexisting hyperkalemia.
- Renal failure (only if not receiving dialysis).

Patients with cocaine intoxication may experience prolonged muscle paralysis with succinylcholine.

- Cocaine is also metabolized by the plasma pseudocholinesterases, thereby acts as a competitive antagonist.
- Also important are the anticholinesterase agents, which include organophosphate and carbamate pesticides, drugs used for myasthenia gravis and Alzheimer.

- Can cause a slight and transient increase in the ICP.
- Increase in intraocular pressure (IOP) is minimal, 3-8 mm Hg.
  - Insignificant.
  - Blinking or coughing can increase IOP 10-15 mm Hg.
- Malignant hyperthermia.

**Rocuronium**

- Aminosteroid muscle relaxant structurally related to vecuronium.
- Possesses the fastest onset of action of all the nondepolarizing NMB agents, close to that of succinylcholine.
- Dosage of 0.6 mg/kg, its onset of action is 60-90 seconds.
Rocuronium

- Major disadvantage in its use is that its duration of action is intermediate, lasting from 30-45 minutes.

Studies by De May et al and Tryba et al have shown that rocuronium is an effective and safe alternative to succinylcholine in those rare clinical situations when succinylcholine is deemed undesirable.

- Only potential risk lies in the fact that if an airway cannot be secured, bag mask ventilation for 45 minutes may be required with all the inherent negative complications associated therewith.

Use of sedation only without paralysis theoretically makes sense because, in the event of a failed intubation, the patient may continue to breathe spontaneously. Unfortunately this argument is not supported by the literature.

In order to produce adequate conditions for intubation, the amount of sedation required generally exceeds that needed to maintain the protective pharyngeal reflexes.

1994, Gnauck et al retrospectively compared complications of orotracheal intubation without paralytics with complications of RSI in pediatric patients in the ED.

- Aspirations occurred in 6% of the group without paralytics compared with 2% in the RSI group
- Intubations attempted without neuromuscular paralysis increased the rate of complications (53% vs 26%) and the risk of more than 1 complication occurring per intubation.
- Multiple attempts occurred in 53% in the nonparalytic group compared with 12% in the RSI group.
Sedation Alone vs. RSI

- 1999, Li and colleagues compared the complication rate of intubating patients with and without paralytics.
- In the nonparalyzed group, 15% had aspirations and 28% had airway trauma, and the mortality rate was 3%.
- None of these outcomes were observed in the RSI group.


Direct Laryngoscopy

- Bag-and-mask ventilation can be lifesaving and sufficient in the early stages of resuscitation, but definitive airway management involves endotracheal intubation.
- Direct laryngoscopy has unparalleled speed and success rates compared with alternative methods of placing tracheal tubes.


Direct Laryngoscopy

- Progressive visualization of the intraoral and hypopharyngeal structures.
- Apply pressure to the patient's cricoid cartilage to compress the underlying esophagus and prevent passive spillage of gastric contents into the pharynx.


Direct Laryngoscopy

- Patient preoxygenated and in the sniffing position.


Direct Laryngoscopy

- Grasp the lighted laryngoscope handle with the left hand.


Direct Laryngoscopy

- Using the finger and thumb of the right hand, gently spread open the patient's jaw and roll the lower lip away from the lower teeth.

Direct Laryngoscopy

- Insert the laryngoscope blade from the right side of the mouth, being careful to avoid the teeth and lip.

Direct Laryngoscopy

- Move the blade further into the oropharynx, under and carrying the tongue toward the left.

Direct Laryngoscopy

- The tip of the curved blade should naturally fall into the vallecula, above the epiglottis.
- Confirm that the lip and tongue do not overlay the lower teeth, then apply upward lift on the laryngoscope in the direction of the handle (at 45 degrees from the plane of the supine patient, or stated another way, upward and toward the patient’s feet).
- Hold your wrist rigid and do not use the laryngoscope as a lever, nor the teeth as a fulcrum.

Direct Laryngoscopy

- Looking directly down the center of the oropharynx, the glottic opening should be visualized as a triangle, with an anterior apex formed by the two white true vocal cords and a posterior base formed by the posterior cartilages.
Adducted vocal cords

Direct Laryngoscopy

Imperative to distinguish the glottic aperture for the more posterior esophagus

Rule #1 for Difficult Airway

“\textit{It is preferable to use superior judgement} \ldots \\
\textit{to avoid having to use superior skill}”.

Direct Laryngoscopy

- Remove the stylette.
- Advance and secure the tube at an average depth of 21 – 23 cm measured at the lip.
- Inflate the cuff sufficient to seal the airway.
- Have the assistant release cricoid pressure... \textit{finally}.

Direct Laryngoscopy

- Once you have visualized the vocal cords do not look away... \textit{for any reason}!
- Grasp the tube between the thumb and two forefingers of the right hand and introduce and advance the tube along the right side of the mouth and pharynx.
- Watch as the tube traverses the cords.

Rules for Difficult Airways

Placement of the ETT within the esophagus is an accepted complication of endotracheal intubation.

\textit{Failure to recognize it... is not!}
**Is the tube in?? ??**

- Tube condensation is not a reliable indicator of intratracheal placement.
- In 1998, Kelly et al. found that 100% of intratracheal tubes exhibited condensation.
- Also found that 83% of endotracheal tubes placed in the esophagus exhibited condensation.


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**Is the tube in?? ??**

- Presence of bilateral axillary breath sounds.
- Absence of gastric sounds or distension.
- End Tidal Carbon Dioxide (Etco₂)
  - Must have adequate blood flow through the pulmonary vasculature.


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**Is the tube in?? ??**

- The patient should exhibit adequate or improving oxygen saturation (SaO₂).
- If desaturation occurs, or if there is significant concern of esophageal placement:
  - Remove the tube
  - Re-institute bag mask ventilation with cricoid pressure.
  - Prepare for re-intubation attempt.

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**What do I do if I don’t get it in?**

- Call for assistance

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**What do I do if I don’t get it in?**

- Proceed to Alternative Techniques
  - Hybrid Laryngoscopes, Bullard
  - Layngeal Airway Mask
  - Fiberoptic intubation
  - Combi-tube
  - Retrograde Intubation
  - Transtracheal Airway, Cricothyroidotomy