

Intubation

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This is a general review of issues relevant to intubation. While the hand skills necessary for performing intubation do take a certain amount of practice, the decision of when to intubate and the choice of technique is of at least equal importance, and is often ignored. While you may not acquire significant “hands on” training in intubating non-neonates during your pediatric residency, you will have the opportunity to learn how to decide when someone should be intubated, as well as the potential complications and problems that may be encountered. THIS KNOWLEDGE MAY BE LIFE-SAVING.

I. Indications for intubation--Thinking about the indications will help you decide on a technique.

- A. Airway patency
- B. Requirement for positive pressure ventilation due to pulmonary disease (ie, hypoxia or hypercarbia)
- C. Significant cardiovascular compromise, shock
- D. Neurologic-seizures, weakness, head injury

II. Techniques

- A. Awake, without drugs
- B. Sedated but not paralysed
- C. Anesthetized-+/- rapid sequence induction

III. Considerations in determining technique used for intubation

- A. Airway anatomy-if primary airway problem, ie, croup, epiglottitis, foreign body, abnormal anatomy, etc., DO NOT BURN BRIDGES. These patients should not be paralysed. Paralysis relaxes the pharyngeal muscles, which may obscure landmarks in the difficult airway, and may make bag-mask ventilation difficult. Sedation, along with local anesthetics (ie, lidocaine spray) may be used to facilitate intubation.
- B. Cardiovascular stability-hemodynamically unstable patients (ie, sepsis, toxic shock, certain ingestions) may become even more unstable when sedated, due to loss of sympathetic tone. Any drugs used should be used in smaller doses and titrated to effect. Patients with primary cardiac disease, however, generally do not tolerate unsedated intubations, and carefully titrated anesthesia is warranted.
- C. Cardiopulmonary arrest-there is no reason to use any pharmacologic intervention. Bag-mask ventilation with cricoid pressure and intubation can generally be accomplished without difficulty.
- D. “Full stomach”--risk of pulmonary aspiration. These patients should be intubated “awake” to preserve airway protective reflexes, or by *rapid sequence induction* with cricoid pressure.
 - 1. Recent oral intake
 - 2. Delayed gastric emptying from ascites, peritonitis, bowel obstruction
 - 3. Swallowed blood from trauma
 - 4. Increased intra-abdominal pressure from masses or ascites
 - 5. Abnormal lower esophageal tone-pregnancy

6. Gastro-esophageal reflux
7. Altered level of consciousness

E. Head injury-laryngoscopy and intubation may lead to increased intracranial pressure in the unanesthetized patient with an evolving head injury. Trauma victims are frequently hypovolemic. Drugs and doses used need to be carefully considered.

IV. The “awake” intubation

A. Indications (all relative)

1. Cardiopulmonary arrest
2. Airway anomalies, acute severe upper airway disease
3. Cervical spine injury
4. Facial Trauma
5. Significant hemodynamic instability
6. Any suspicion of difficulty intubating, for any reason.

B. Technique

1. Local anesthetic sprays can be used to topicalize the tongue and pharynx. Nebulized lidocaine (2cc 1% lidocaine in nebulizer) will decrease the laryngospasm and bronchospasm with intubation.
2. Laryngoscopy and intubation should proceed firmly but gently, with attention to the teeth and tongue if the child is struggling

V. The sedated intubation

A. Indications

1. Potentially difficult airway
2. Lung disease with moderate to high O₂ requirement (may desaturate during period of apnea necessary for rapid sequence intubation)

B. Technique

1. Carefully titrated drugs, watching for hemodynamic as well as sedative effects. If hemodynamics are stable, more drug can be given if necessary.
 - a. Versed, 0.05-0.1 mg/kg. Use lower doses in the setting of hypovolemia, sepsis, or poor cardiac function.
 - b. Ketamine, 0.5-2.0 mg/kg. Indirect sympathomimetic, preserves cardiac output and systemic BP in acutely hypovolemic patients. Direct bronchodilatory properties. Potent sialogogue (premedicate with atropine or glycopyrrolate). Co-administration of a small dose of benzodiazepine will reduce emergence phenomena.
2. Monitor degree of sedation carefully. Watch for signs of impending vomiting or respiratory depression. Gentle ventilatory assistance through cricoid pressure is sometimes necessary in extremely hypoxic or unstable patients.

VI. The anesthetized intubation--rapid sequence induction

A. Indications

1. “Full stomach” conditions
2. Head injury
3. Asthma
4. Common theme-Desire to blunt undesirable physiologic response to

intubation-hypertension, tachycardia, bronchospasm, increased intracranial pressure.

B. Contraindication-anticipated difficulty with securing airway, ie, anatomic abnormality or airway pathology. **NEVER** sacrifice airway safety for the sake of pharmacologic intervention.

C. Technique-rapid sequence refers to rapid infusion of medications, followed by a brief period where airway protective reflexes are lost, followed by ideal intubating conditions. During the period after medications are given, cricoid pressure is applied and positive pressure ventilation is avoided.

1. Preoxygenate with 100% O₂
2. NG (if present) to suction. Have suction (LARGE Yankauer) available!!!
3. Medication sequence--**cricoid pressure** should be applied from the moment drugs are given until the ETT is confirmed to be in the proper position. No positive pressure ventilation.
 - a. Atropine
 - b. Sedation
 - c. Paralysis
4. When fully relaxed, intubate.
5. If difficulty with intubation arises, or the patient had more lung disease than you anticipated and desaturates significantly without positive pressure ventilation, GENTLY BAG MASK VENTILATE the patient, get the saturations up, and try again.

D. Drugs to facilitate intubation

1. Atropine 0.02 mg/kg, minimum 0.1 mg
2. Sedation-Benzodiazepine +/- narcotic, or ketamine, or thiopental.
 - a. Versed 0.05-0.1 mg/kg
 - b. Morphine 0.2 mg/kg or fentanyl 1-2 mcg/kg
 - c. Ketamine 0.5-2 mg/kg
 - d. Thiopental 2-6 mg/kg
3. Paralysis
 - a. Rocuronium 1.2 mg/kg, achieves intubating conditions in 60 seconds. Duration of paralysis 30-60 minutes. Should not be used if there is any anticipated difficulty achieving intubation.
 - b. Succinylcholine 1-2 mg/kg, achieves intubating conditions in 45 seconds. Duration of paralysis 5-8 minutes. This is a long time if you can't get the airway or bag mask ventilate the patient. BE CAREFUL. In children over 4 years of age, a defasciculating dose of vecuronium or pancuronium (**0.01** mg/kg) can precede the succinylcholine to prevent muscle fasciculations and elevation in intragastric pressure.

E. Untoward effects of succinylcholine

1. Cardiovascular-succinylcholine stimulates the vagus nerve and sympathetic ganglia leading to bradycardia, hypertension, or hypotension. Atropine prior to administration may prevent bradycardia.
2. Hyperkalemia-With depolarization there is opening of acetylcholine receptor channels, allowing efflux of potassium from the cell through receptors in the

muscle end-plate and extra-junctional receptors. In normal patients, there is a rise in serum potassium of 0.5 meq with a dose of succinylcholine. In certain disease processes, there is an upregulation of acetylcholine receptors, and hence, a massive increase in serum potassium with the administration of succinylcholine.

These include: burns (3 days to 6 months after injury), spinal cord injury (3 days to 1 year after injury), tetanus, severe intra-abdominal infections, Guillain-Barre syndrome, Duchenne's Muscular Dystrophy, Myotonic Dystrophy, multiple sclerosis, many progressive neuromuscular diseases.

3. **Malignant hyperthermia**-Succinylcholine is one of the agents that "trigger" MH, a hypermetabolic response to a triggering agent characterized by fever, tachycardia, tachypnea, acidosis, hyperkalemia, ventricular dysrhythmias, and rhabdomyolysis. The mortality is high. Risk factors include positive family history, Duchene's Muscular Dystrophy, and certain myopathies.

4. Increased intraocular pressure

5. Rhabdomyolysis and myoglobinuria

6. Muscle pain-reduced if a defasciculating dose of pancuronium is used

7. Increased intragastric pressure

8. Increased intracranial pressure-blunted by pretreatment with adequate sedation and a defasciculating dose of pancuronium.

Equipment

For any and all intubations, have available:

- C Large suction catheter** "Yankauer" and reliable suction.. 2 suction setups if bleeding. DO NOT use small suction catheters.
- C Bag** and appropriate sized **mask**
- C Oxygen** source
- C Endotracheal tubes**--one up, one down from anticipated size needed
- C Laryngoscopes**-at least 2, preferable 1 straight blade, one curved blade. **CHECK LIGHTS**
- C Stylet**, with lubrication
- C Oropharyngeal** airways
- C Tape**
- C CO2** monitoring device
- c Ventilation** system