Medications

- Pretreatment agents
- Induction agents
- Neuromuscular blockers
Pretreatment agents

- Attenuate adverse pathophysiologic responses to laryngoscopy and intubation
  - Reflex sympathetic response
    - Increase in heart rate and blood pressure
    - Increase in intracranial pressures
  - Laryngeal stimulation
    - Laryngospasm, cough, and bronchospasm

- To be effective, pretreatment agents should be given 3-5 min prior to RSI

- Not practical at most times and not routinely used
Pretreatment

- **Lidocaine**
- Opioid
- Atropine
- Defasciculating agent

- **Dose:** 1.5 mg/kg IV
- To prevent rise in ICP by
  - Preventing cough
  - Blunting pressor response
- May reduce reactive bronchospasm in asthma when added to albuterol
- *Helpful in awake intubation*
Pretreatment

- Lidocaine
- **Opioid**
- Atropine
- Defasciculating agent

- Fentanyl
Opioids

- **Fentanyl**
  - 0.2-0.3 μg/kg IV
  - Onset of action: 30 sec, Duration: 30-60 mins
  - Short-acting, potent
  - Sedation is rate- AND dose-dependent
  - Combined with other induction agents for analgesia
  - Adverse effects
    - hypotension and bradycardia
    - muscle rigidity, can make it difficult to bag
    - grand mal seizures (rare)
Pretreatment

- Lidocaine
- Opioid
- **Atropine**
- Defasciculating agent

- **Dose:** 0.02 mg/kg
- To prevent bradycardia caused by airway manipulation and succinylcholine
  - Used in pediatrics. Not usually used in adults
  - Can cause arrhythmias

  - May be more beneficial with repeated doses of succinylcholine (i.e. OR setting)
Pretreatment

- Lidocaine
- Opioid
- Atropine
- Defasciculating agent

- Fasciculations occur in >90% of patients given succinylcholine
  - Muscle pain
  - Increase intragastric pressure → emesis
  - Increase ICP (?)
- Higher doses of succinylcholine (1.5 mg/kg vs 1 mg/kg)
- Non-depolarizing NMB (1/10\textsuperscript{th} of paralytic dose)
Step 1: Pretreatment: blunts sympathetic drive

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosage</th>
<th>Onset</th>
<th>Duration</th>
<th>Cautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fentanyl</td>
<td>0.2-0.3 µg/kg</td>
<td>30 s</td>
<td>30-60m</td>
<td>Hypotension, bradycardia</td>
</tr>
</tbody>
</table>
Induction Agents

- Given as rapid IV push *immediately* before paralyzing agent
- Ideally provides:
  - Rapid loss of consciousness
  - Analgesia
  - Amnesia
  - Stable hemodynamics
- Most commonly used
  - Etomidate
  - Propofol
Etomidate

- Non-barbiturate hypnotic
  - 0.3 mg/kg
  - Onset: 30 – 60 sec, Duration: 3-5 mins
  - Hemodynamic stability: least depression of cardiac output
  - Decrease intracranial pressure with minimal effects on cerebral perfusion
- **NO** analgesia
- Adverse effects:
  - Myoclonic jerks, not seizure with induction dose
  - Decrease cortisol production: inhibits 11-β-hydroxylase for 4-8 hours with induction dose. Continuous infusion increase mortality
  - Cough and hiccups: not ideal with LMA
Propofol

- 0.5 – 2 mg/kg
- Onset: 30 sec, Duration: 3 – 10 mins
- Systemic vasodilation and profound hypotension
- Respiratory depression
- Adverse effects
  - Hypotension
  - Bradycardia
  - Movements with induction (not seizure)
  - Propofol infusion syndrome
Ketamine

- NMDA-antagonist and blocks glutamate → dissociative anesthesia
  - Analgesic, amnestic, catalepsy
- 1.5 - 2 mg/kg IV
- Onset: 30 sec, Duration: 5-15 mins
- Sympathomimetic effects (↑ HR, BP, CO, ICP)
  - Helpful in hemodynamic unstable patients
  - Maintains respiration and airway reflexes
  - Bronchial smooth muscle relaxant
    - helpful in obstructive lung disease
- Adverse effects/Contraindications
  - Elevates intracranial pressures, contraindicated in head injuries
  - Coronary artery disease
  - Emergence delirium, hallucinations
    - Premed: midazolam 0.07 mg/kg
  - Emesis, mostly in adolescents
  - Schizophrenia/schizoaffective disorder, especially within last 3 months
  - Increase salivation: reduced if premedicated with glycopyrrolate
Dexmedetomidine

- Used for awake, fiberoptic intubation
- Adverse effects
  - Bradycardia
  - Hypotension

Infuse Precedex with a controlled infusion device.

In patients already sedated with other anesthetics, sedatives, hypnotics or opioid analgesics, a Precedex loading dose may not be necessary.

Coordination of anesthetics, sedatives, hypnotics and opioids with Precedex can enhance the pharmacodynamic effects of these agents. A reduction in the dosage of Precedex or the concomitant medication may be required.

Patients receiving Precedex may be arousable and alert when stimulated. This alone should not be considered as evidence of lack of efficacy in the absence of other clinical signs and symptoms.

Premedicate With Glycopyrolate 0.1 mg IV Helps minimize aspiration risk by:
- Reducing salivary, tracheobronchial and pharyngeal secretions
- Reducing volume and free acidity of gastric secretions

Glycopyrolate can also be used intraoperatively to counteract surgical, drug-induced or vagal reflexes associated with arrhythmias and protect against peripheral muscarinic effects (e.g., bradycardia and excessive secretions) of cholinergic agents.

Start Supplemental Oxygen by Nasal Cannula or Face Mask

Prepare Precedex

- Withdraw entire 3 mL contents of the Precedex vial
- Add to 48 mL of sodium chloride injection to total 50 mL
- Shake gently to mix well

Initiate Precedex Loading Dose one (1) mcg/kg over 10 min

After 10 min, Continue Precedex Maintenance Infusion at 0.7 mcg/kg/hr

Assess Sedation Level

15 min after initiating Precedex and every 3 min thereafter

Undersedated
Ramsey Sedation Score (RSS) = 1
RSS 1 = Patient anxious and agitated or restless or both
Administer 0.5 mg midazolam as needed (maximum 0.2 mg/kg) until RSS ≥2

Adequately Sedated
RSS 2 or more
RSS 2 = Patient cooperative, oriented and tranquil
RSS 3 = Patient responds to command only
RSS 4 = Patient exhibits brisk response to light globular (between eyebrows) tap or loud auditory stimulus
RSS 5 = Patient exhibits sluggish response to light globular tap or loud auditory stimulus
Maintain Precedex

Apply Airway Topical Anesthesia

- Deliver nebulized 4% lidocaine (2 to 4 mL) over 10 min using a standard nebulizer with oxygen 8 to 10 L/min
- If possible, have the patient gavage with 4% viscous lidocaine (1 to 2 mL)
- For nasal intubation, place 2% lidocaine jelly (1 to 2 mL) within the nostril
- Assess sedation level (target RSS ≥2)

Assess Topicalization

- Oral Intubation: Stimulate the uvula, tongue and bilateral posterior pharyngopalatine faucæ with a wooden tongue blade
- Nasal Intubation: Stimulate the posterior nares at least 3 cm from the anterior nares with a soft-tipped swab stick in addition to stimulating the uvula, posterior tongue and bilateral posterior pharyngopalatine faucæ with a wooden tongue blade

Intubate the Patient After Adequate Topical Anesthesia, RSS ≥2 and Absence of Gag Reflex

- Administer additional 2% lidocaine (1 to 2 mL aliquots) to the lower airway via the working channel of the bronchoscope
- Ask the patient to take slow, regular and deep breaths to facilitate distribution of the local anesthetic to the lower airway
- Administer 0.5 mg midazolam as needed (maximum 0.2 mg/kg) until RSS ≥2

Expected Moderate Decreases in BP & HR If indication is required, consider:
- Reducing Precedex dosage
- Discontinuing Precedex
- Administering intravenous fluid
- Elevating lower extremities
- Administering glycopyrolate or atropine

Transient Hypertension Also May Occur

This occurs primarily during the loading infusion. Treatment has generally not been necessary, although reduction in the loading infusion rate may be desirable.

Safety Considerations

Hypotension and bradycardia may necessitate intervention and may be more pronounced in patients with hypovolemia, diabetes mellitus or chronic hypertension as well as in the elderly. Use with caution in patients with advanced heart block or severe ventricular dysfunction.

For more information on Advancing Wellness™
Benzodiazepines

- **Midazolam**
  - 0.1 – 0.4 mg/kg IV
  - Onset: 3-5 mins, Duration: 2-6 hours
  - Sedative, amnestic, muscle relaxant
    - **NOT** analgesic
  - Less cardiorespiratory depression vs. other benzos
  - Adverse effects
    - Hypotension, tachycardia
    - Use lower dose in hypovolemic, elderly, or traumatic brain injury patients (0.05 mg/kg)

- Generally never used alone
### Step 2: Induction: causes unconsciousness

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<th>Cautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Etomidate</td>
<td>0.3 mg/kg</td>
<td>30-60 s</td>
<td>3-5m</td>
<td>decrease seizure threshold, low cortisol</td>
</tr>
<tr>
<td>Propofol</td>
<td>0.5-2 mg/kg</td>
<td>30 s</td>
<td>3-10m</td>
<td>Hypotension</td>
</tr>
<tr>
<td>Ketamine</td>
<td>1.5-2 mg/kg</td>
<td>30 s</td>
<td>5-15m</td>
<td>CAD, HTN, hallucination, seizure, ICP</td>
</tr>
<tr>
<td>Midazolam</td>
<td>0.2 mg/kg</td>
<td>3-5 m</td>
<td>2-6h</td>
<td>Hypotension</td>
</tr>
</tbody>
</table>
**Neuromuscular Blocking Agents (NMBAs)**

- *Contraindicated if difficult to ventilate* or anticipating difficult airway

- **Advantages**
  - Allow complete airway control
    - Higher success (100% vs 82%)
    - Less aspiration and airway trauma
  - Enable lower doses of sedative
    - Better hemodynamic stability

- **Depolarizing**

- **Non-depolarizing**
• Depolarizing agents
  - Succinylcholine

• Non-depolarizing Agents
  - Pancuronium
  - Vecuronium
  - Atracurium
  - Rocuronium
  - Cis-atracurium
  - Mivacurium
Succinylcholine

- Gold standard for use in RSI
- 1.5 mg/kg IV
- Onset in 30 - 60 sec. Duration ~ 5 min
  - Prolonged in pseudocholinesterase deficiency (genetic, hepatic/renal failure, pregnancy, cocaine)
  - Repeat doses prolong paralysis
    - May increase bradycardia/hypotension
Succinylcholine

- **Adverse effects**
  - Muscle fasciculation
  - Hyperkalemia
    - Avoid in renal failure, burns, crush injuries, neuromuscular disorders, CVAs
  - Bradycardia/hypotension
  - Mild increase in ICP
  - Malignant hyperthermia
    - Treatment: cooling, volume repletion, and Dantrolene sodium (1-2 mg/kg IV)
  - Trismus
Non-Depolarizing NMBAs

- **Rocuronium**
  - Dose: 0.6 - 1.2 mg/kg
  - Onset: 1-2 min, Duration: 45-70 min
  - Non-vagolytic; no histamine release
  - No active metabolites
  - *Preferred alternative to succinylcholine in rapid sequence intubation*
Non-Depolarizing NMBAs

- Cisatracurium
  - Dose: 0.15 – 0.2 mg/kg IV
  - Onset: 1.5 – 2 mins, Duration: 55-60 mins
  - More commonly causes bradycardia than other NMBAs
  - Excreted by Hoffman excretion
    - No accumulation in renal or hepatic failure
Non-Depolarizing NMBAs

- **Pancuronium**
  - Dose: 0.10-0.15 mg/kg IV
  - Long time to onset (1-5 min) and duration (45-90 min)
  - Vagolytic effect: tachycardia and hypertension
  - Histamine release → bronchospasm/anaphylaxis
  - Active metabolites
  - Accumulates in renal failure
    - Renal dosing required

- **NOT recommended for rapid sequence intubation**
Non-Depolarizing NMBAs

- Vecuronium
  - Slower onset 1-4 min, duration 30-60 min
  - Non-vagolytic; no histamine release
  - Can cause hypotension
  - Active metabolites
  - Biliary excretion
  - Often requires “priming” dose
    - 0.01 mg/kg during pre-oxygenation phase, then
    - 1.5 mg/kg given 3 min later for paralysis

- NOT recommended for rapid sequence intubation
### Step 3: Paralytics: ensure able to bag patients before giving, Only use if needed

<table>
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<tr>
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<th>Duration</th>
<th>Cautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Succinylcholine</td>
<td>1.5 mg/kg</td>
<td>30-60 s</td>
<td>5-15m</td>
<td>Malignant hyperthermia, hyperK burn, trauma, demyelinating dz</td>
</tr>
<tr>
<td>Rocuronium</td>
<td>0.6-1 mg/kg</td>
<td>1-2 m</td>
<td>45-70m</td>
<td>Allergy to aminosteroid, consider dose reduction in hepatic dz</td>
</tr>
</tbody>
</table>
COMPLICATIONS OF ENDOTRACHEAL INTUBATION
Complications of Intubation

- Difficult intubation ~ 10%
- Airway related complications 4%

Risk factors:
- Multiple attempts, 3 or more
- In emergency room on general floors
- Difficult intubation: high Mallampati score
Patient factors

- Infant, children and women
  - Small larynx and trachea
- Difficult airway
- Congenital and chronic acquired diseases
- Emergent intubation
Operator Related Factors

- Anesthesiologist – CRNA – ER Doc/CCM – Hospitalist – Resident

1. Knowledge, technical skills
2. Crisis management capabilities
3. A HURRIED intubation,

- without adequate *evaluation* of the airway or *preparation* of the patient & equipment - more likely to cause damage.
Equipment

- The shape of the endotracheal tube (ETT) - maximal pressure on the posterior aspect of the larynx.
- Size of the tube & duration of intubation.
- Stylets and bougies predispose to trauma.
- Additives to plastic - tissue irritation.
- Cuff related injuries with high pressure.
PART 1

Complications requiring immediate recognition and management
Complications requiring immediate recognition and management

- Failed intubation
- Hemodynamic instability/ cardiac arrest
- Esophageal intubation
- Bronchial intubation
- Spinal cord and vertebral column injury
- Noxious autonomic reflexes
- Hypertension, tachycardia, arrhythmias
- Intracranial and intraocular hypertension
- Bronchospasm
- Laryngospasm
• Acute traumatic complications
• lips, teeth, tongue, nose, pharynx, larynx, trachea, bronchi

• Tension pneumothorax

• Disconnection and dislodgement

• Failure to achieve satisfactory seal

• Aspiration of gastric contents
Obstruction of the tube

- Biting of the ETT.
- Kinking of the ETT.
- Material in the lumen of the tube.
  - Secretions, blood clots, nasal turbinates, adenoids
- Defective spiral embedded tubes.
- Impaction of the tip against the tracheal wall
  - Murphy’s eye
- Herniation of the cuff over the lumen of the tube
PART 2

Complications of lesser significance and Complications after extubation
- Temporomandibular joint injury
- Nasal injury
- Dental injury
- Soft palate injury
- Tongue injury
- Pharyngeal trauma
- Laryngeal trauma: *ulcerations, erosions*
- Arytenoid injury
- Vocal cord: *paralysis, granuloma*
- Delayed tracheal injury: *stenosis and tracheomalacia*
- Fistula
  - *Tracheo-esophagea Tracheo-innominate*
Thank you
- Meet at 1 pm at wiser center
- 20 mins at each station

- Group 1: Bag mask ventilation
- Group 2: Laryngoscopes: mac and miller blades
- Group 3: Glidescope
- Group 4: Difficult airway

- Post test
Hands-on experience

- 1 week of OR rotation with anesthesia
  - 5 intubations using laryngoscope
  - 15 intubations using video-laryngoscope
  - 10 laryngeal mask airway placement

  - The residents will be responsible for getting the procedures signed in the log book.

- All the intubations have to be supervised by either critical care or emergency medicine physicians, even after successfully completing the course.

- All the intubations performed by residents outside of OR, have to be performed with video-laryngoscope.