Rapid-Sequence Induction For Emergency Intubation

Rapid-Sequence Intubation (RSI)

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Purpose of RSI

- RSI
  - Rapidly induce anesthesia
  - Rapidly achieve N-M blockade (paralysis)

- Purpose
  - Facilitate intubation
  - Blunt CV & ICP responses to intubation

Infant v.s. Adult Airways

Difficult Intubation

- Congenital anomaly
  - difficulty visualizing the cords
- Trauma / tumor
  - difficulty opening the mouth, airway compression, and/or hemorrhage
- Obstruction / infection
  - difficulty visualizing the cords

Indications for Intubation

- Protect airway
- Respiratory failure
- IICP / brain herniation
- Decompensated shock

Proceed to RSI !!
Prepare for RSI: SOAP-ME

- **S**: Suction
- **O**: Oxygen
- **A**: Airway Equipment
- **P**: Pharmacology
- **ME**: Monitoring Equipment

**SOAP-ME**

- **Airway Equipment**
  - Oral and nasal airways
  - Bag-valve-mask (BVM) devices and masks
  - Endotracheal (ET) tubes and stylets
  - Laryngoscope handles and blades
  - Magill forceps
  - Surgical airway equipment
  - Tracheostomy tubes

- **P** - Pharmacology
  - Atropine
  - Lidocaine
  - Sedatives
    - Ketamine, BDZ, thiopental, fentanyl, etomidate, propofol
  - N-M blocking agents
    - Succinylcholine, vecuronium, rocuronium

- **ME** - Monitoring Equipment
  - ECG monitor
  - Pulse oximeter
  - BP monitor
  - End-tidal CO2 detector / monitor

RSI 之步骤: Overview

- AMPLE & anatomy
- Prepare: SOAP-ME
- Preoxygenation: 100% O2 +/- BVM
- Premedications
- Paralysis
- Pressure: Sellick maneuver
- Pass the tube
- Check & secure the tube
**Initial Assessment: History**

- **A-M-P-L-E**
  - Allergies
  - Medications, drugs of abuse
  - Past medical problems, problems with anesthesia
  - Last meal
  - Events, including prehospital course

**Anatomic Assessment**

- **Head:**
  - Trauma
- **Face / mouth:**
  - Trauma, open mouth, tongue size, uvula, loose teeth, dentures
- **Neck / C-spine:**
  - Trauma, masses / hematomas, short thick neck, tracheal shift
- **Brief NE**
  - Document any neurologic deficits before paralysis

**Preoxygenation**

- Adequate ventilation
  - 100% O2 via non-rebreathing mask
- Inadequate spontaneous ventilation
  - 100% O2 via BVM
- Apnea without hypoxemia
  - Up to 30 seconds

**Premedication**

- **Atropine**
  - Function
    - Prevent / treat bradycardia
    - Decrease secretions
  - Indications
    - Age < 1Y
    - Age < 5Y receiving succinylcholine (SCh)
    - Any patient receiving a second dose of SCh
    - Any patient with bradycardia at time of intubation
  - Dose: 0.02 mg/kg, min 0.1 mg, max 0.5 mg
- **Lidocaine**
  - Blunt ICP response to intubation
  - Dose:
    - 1 mg/kg, slow IV push
    - 1 to 2 minutes before the paralytic drug
Sedative Agents

♦ Induce unconsciousness
  – Minimize reflex responses to intubation
♦ Choice and dose
  – Depend on clinical settings

Thiopental

♦ Short-acting barbiturate
♦ Benefits in head trauma
  – Decreases ICP
  – Blunts ICP response to intubation
♦ Myocardial depressant
  – Avoid or use low dose when hypotension or hypovolemia present
♦ Dose: 3-5 mg/kg IV

Ketamine

– Dissociative anesthetic agent
– Unaware of surroundings
– Analgesia and amnesia
– Maintains airway reflexes
– Cardiorespiratory stability: may increase BP, HR, cardiac output
– Bronchodilating effect
– 1-2 mg/kg IV or 4-7 mg/kg IM

Ketamine

♦ Hallucinations, nightmares, and "emergence reactions"
  – Adolescents and adults
  – BDZ may prevent emergence reactions
♦ Increase ICP
  – Contraindicated in head trauma
♦ Increase oral & airway secretions
  – Can use in combination with atropine

Benzodiazepines

♦ Sedative, amnestic, anticonvulsant properties
♦ No analgesic effects
♦ Potential cardiovascular and respiratory depression
♦ Midazolam has fastest onset, shortest duration; dose = 0.1-0.2 mg/kg, max 5 mg
♦ Induction doses in RSI are much higher than usual doses for sedation

Fentanyl

♦ Rapid-onset, short-acting narcotic
♦ Potential uses in RSI
  – Sedative and induction agent
  – Dose for induction (2-10 ug/kg) of unconsciousness much higher than dose for premedication or conscious sedation
Propofol, Etomidate

- Rapid onset, short duration
- Cerebral protective effects
- Cardiovascular depression uncommon with etomidate
- Propofol may decrease BP

Paralysis: N-M Blockade

- Depolarizing agents
  - Succinylcholine (SCh)
- Non-depolarizing agent
  - Vecuronium
  - Rocuronium
  - Pancuronium
  - Others

Succinylcholine

- Binds to ACh receptors on muscle and depolarizes muscle persistently
- Fastest onset
- Shortest duration
- Dose:
  - 1.0-1.5 mg/kg (BW > 10 kg)
  - 1.5-2.0 mg/kg (BW < 10 kg)

Succinylcholine

- Increased intragastric pressure
- Increased intraocular pressure
- Increased ICP
  - Mechanism unclear
  - Prevent or blunt with:
    - Lidocaine
    - Induction agents
    - Small dose nondepolarizing NMB agent

Succinylcholine

- Bradycardia
  - Premedicate young children with atropine
- Tachycardia
  - Sympathetic stimulation
- Hyperkalemia
  - Develops several days after burns, massive muscle trauma, neurologic injuries, various neuromuscular diseases
- Fasciculations
  - Pain, increase intragastric / intraocular pressure

Nondepolarizing NMB Agents

- Compete with ACh for muscle ACh receptors
- No muscle stimulation or fasciculations
- Slower onset, longer duration than SCh
- Usually given before induction agent because of slower onset
Vecuronium (1)
- May be used as paralyzing agent in RSI, especially if SCh contraindicated
- Minimal cardiovascular effects
- "Standard" dose: 0.1 mg/kg
- RSI dose: 0.2 to 0.3 mg/kg, has faster action and prolonged duration
- Defasciculating dose: 0.01 mg/kg

Vecuronium (2)

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Dose, mg/kg</th>
<th>Onset</th>
<th>Duration, min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defasculation</td>
<td>0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSI</td>
<td>0.2-0.3</td>
<td>60-90</td>
<td>90-120</td>
</tr>
<tr>
<td>Paralysis after intubation</td>
<td>0.1</td>
<td>2-3 min</td>
<td>25-40</td>
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Rocuronium
- Fastest acting nondepolarizing NMB agent
- Dose: 0.8-1.2 mg/kg
- Duration: Up to 60 minutes

Defasculation
- Agents and dosages
  - Vecuronium 0.01 mg/kg
  - Pancuronium 0.01 mg/kg
- Indication
  - Age > 5Y
  - Succinylcholine for paralysis

5 yr boy, 20 kg
- A: Unconscious
- B: RR 10
- C: PR 140, BP 70/?
- D: E2M4V2, P 5/3

Head Injury / IICP
- Atropine?
- Lidocaine?
- Defasciculating agents?
  - Vecuronium, pancuronium
- Sedatives?
  - Ketamine, BDZ, thiopental, fentanyl, etomidate, propofol
- N-M blocking agents?
  - Succinylcholine, vecuronium, rocuronium
Head Injury / IIICP
✓ Atropine
✓ Lidocaine
✓ Defasciculating dose of vecuronium
✓ Thiopental
  • Ketamine will increase ICP
✓ Succinylcholine

11-year-old girl
♦ PH: Bed-ridden due to cerebral palsy
♦ PI: Fever and altered mental status
♦ A: Obtunded, rigidity
♦ B: Tachypneic
♦ C: Skin, hot and dry

Muscle disease or paralysis
  – Atropine?
  – Lidocaine?
  – Defasciculating agents?
    – Vecuronium, pancuronium
  – Sedatives?
    • Ketamine, BDZ, thiopental, fentanyl, etomidate, propofol
  – N-M blocking agents?
    • Succinylcholine, vecuronium, rocuronium

HR 135; RR 36; BP 80/60; T 40° C ;
BW 18 kg; SO2 84% (room air)

What are your options now?
♦ After etomidate is given, patient is paralyzed with 1.0 mg/kg of Rocuronium
♦ First attempt at intubation fails
**Nondepolarizing NMB agent**

- Failed intubation
  - Begin BVM ventilation
  - Prepare for another intubation attempt
  - Consider giving a reversal agent
    - Neostigmine
    - Edrophonium
    - Pyridostigmine
  ** Pretreat with atropine

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**Asthma**

- A: Extremely anxious
- B: Retractions in all areas
- C: Pale and diaphoretic

- No response to O2, albuterol, and epinephrine.
- Lethargic, HR 120; RR 10; SO2 82%

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**Asthma**

- Atropine?
- Lidocaine?
- Defasciculating agents?
  - Vecuronium, pancuronium
- Sedatives?
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**Asthma**

- Atropine
  - Lessen secretions due to use of ketamine
- Lidocaine
- Defasciculating dose of vecuronium
- Ketamine + Midazolam
  - Thiopental may cause bronchospasm
- BDZ decrease emergence reaction
- Succinylcholine

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**Post-intubation**

- Agents to lessen agitation
  - Benzodiazepine
    - For sedation
    - E.g. Dormicum, lorazepam
  - Nondepolarizing NMB agent
    - For continued paralysis
    - E.g. Vecuronium

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**Patient intubated after atropine, ketamine, midazolam and SCh given in RSI**

- 6.0-mm ET tube inserted and secured
- Patient agitated and fighting ventilator

*What agents can be used to lessen the agitation?*
Always have “plan B”