What’s New With RSI Drugs? 
State-Of-The-Art Review

Michael Gibbs, MD, FACEP
Department of Emergency Medicine
Maine Medical Center
Portland, Maine  U.S.A.

gibbsm@mmc.org
Rapid Sequence Intubation

Rapid sequence intubation (RSI) involves the rapid and simultaneous administration of a short-acting sedative and a paralytic agent to facilitate intubation and decrease the risk of aspiration.
The 7 P’s Of RSI

- Preparation
- Preoxygenation
- Pretreatment
- Paralysis WITH sedation
- Protection + Positioning
- Placement with Proof
- Post-intubation management

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The 7 P’s Of RSI

- Pretreatment
- Paralysis WITH sedation
Pretreatment

The delivery of drugs to reduce the “RSRL”

[Reflex sympathetic response to laryngoscopy]

National Emergency Airway Course®
The RSRL results from physical manipulation of the airway

**Not** eliminated by paralysis

**Consequences:**
- Catecholamine release
- Hypertension, tachycardia
- Increased ICP in patients with impaired cerebral autoregulation
Who is at risk?

- Medical intracranial hypertension
- Traumatic brain injury
- Vascular emergencies
- Cardiac ischemia
## Pretreatment – “LOAD”

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>L</strong>idocaine</td>
<td>1.0 mg/kg</td>
</tr>
<tr>
<td><strong>O</strong>piates</td>
<td>3-5 µg/kg</td>
</tr>
<tr>
<td><strong>A</strong>tropine</td>
<td>0.02 mg/kg</td>
</tr>
<tr>
<td><strong>D</strong>efasculation [eg: vecuronium]</td>
<td>0.01 mg/kg</td>
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# Lidocaine: What Do We Know?

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
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<tbody>
<tr>
<td>Do hemodynamic alterations during RSI have the potential to increase ICP?</td>
<td>YES</td>
</tr>
<tr>
<td>Does lidocaine blunt this response?</td>
<td>YES</td>
</tr>
<tr>
<td>Is there evidence that lidocaine improves outcome in at-risk patients?</td>
<td>NO</td>
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# Fentanyl: What Do We Know?

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<td>Do hemodynamic alterations during RSI have the potential to increase ICP?</td>
<td>YES</td>
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<tr>
<td>Does fentanyl blunt this response?</td>
<td>YES</td>
</tr>
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<td>Is there evidence that fentanyl improves outcome in at-risk patients?</td>
<td>NO</td>
</tr>
<tr>
<td>Can fentanyl precipitate hypotension?</td>
<td>YES</td>
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</table>
### Defasciculation: What Do We Know?

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<td>Do SCH-associated fasciculations increase ICP?</td>
<td>YES</td>
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<tr>
<td>Does pretreatment with a non-depolarizer reduce this phenomena?</td>
<td>YES</td>
</tr>
<tr>
<td>Is there evidence that SCH worsens outcome in at-risk patients?</td>
<td>NO</td>
</tr>
<tr>
<td>Is there evidence that defasciculation improves outcome in at-risk patients?</td>
<td>NO</td>
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Pretreatment

Aneurysmal Subarachnoid Hemorrhage
Pretreatment

Traumatic Brain Injury

FIG. 10-7. Intracranial volume-pressure curve. As ICP rises, equivalent changes in volume produce increasing pressure response. (From Jones et al. 133 with permission.)
Secondary Injury In TBI

- Prospective study of 717 patients with severe TBI at 4 centers.
- A single episode of hypotension (BP <90) or hypoxia (PaO₂ <60) during the initial resuscitation was associated with a 150% increase in mortality.

Chestnut RM. *J Trauma* 1993; 34:216.
Pre-treatment

Acute Aortic Dissection
Pretreatment

Acute Myocardial Ischemia
Paralysis WITH Sedation

**Goal:** optimal intubating conditions

- Administered simultaneously
- Agent synergy important
- Don’t be temped to omit sedation in the “comatose” patient!
RSI Induction Agents

Important side effects:
- Apnea
- Myocardial depression
- Hypotension
- Others, drug-specific
RSI Induction Agents

- Midazolam
- Thiopental
- Propofol
- Ketamine
- Etomidate
RSI Induction Agents

Midazolam:
- Commonly used if etomidate n/a
- Little effect on RSRL or ICP
- Dose-dependent respiratory depression & hypotension
- Often under-dosed [NEAR mean = 4 mg]

0.1-0.3 mg/kg
RSI Induction Agents

Thiopental:
- Significant benefit in acute CNS pathology
- Decreases ICP at the expense of CPP
- Hypotension the major downside

3-5 mg/kg adult
5-6 mg/kg pediatric
RSI Induction Agents

Propofol:
- Pharmacologically similar to thiopental
- Decreases ICP at the expense of CPP
- Hypotension a significant risk

0.5-1.2 mg/kg
RSI Induction Agents

Ketamine:
- Catecholamine release
- Typically augments blood pressure
- Direct bronchodilator
- Increased ICP in the setting of TBI?

1-2 mg/kg IV, 2-4 mg/kg IM
Ketamine In TBI?

Effects of IV ketamine on ICP/CPP/MAP in 8 ventilated TBI patients with ICP monitors in place:

- ICP reduced
- No alteration in CPP or MAP

Albanese J. *Anesthesiology* 1997; 87:1328.
Ketamine In TBI?

- Several authors have recently questioned the historical dogma.
- Ketamine potentially advantageous in the *hypotensive* head injury patient.
- No data in the ED RSI population.


RSI Induction Agents

Etomidate:
- Minimal effect of hemodynamics
- Reduces ICP while maintaining CPP
- Side effects:
  - Transient adrenal suppression
  - Myoclonus – avoided by paralysis

0.15-0.3 mg/kg
Prospective study of 522 ED RSI cases using etomidate.

Outcome measures:
- Ease of intubation
- Hemodynamics [BP$_S$, BP$_D$, HR] at the time of intubation, 5 minutes, 15 minutes

Etomidate In The ED

Results:
- Intubation “excellent/good” in 96.9%
- BP & HR *increased* at 0, 5, 15 minute
- Similar findings in a subgroup of 80 patients with an initial BP <100 mmHg

“Should We Use Etomidate as an Induction Agent for Edotracheal Intubation in Patients With Septic Shock?: A Critical Appraisal”

Chest 2005; 127:1031-1038

**Rationale:**
- Single dose etomidate causes transient cortisol suppression
- Adrenal insufficiency is highly prevalent in sepsis
- Mortality is increased when adrenal insufficiency is present
- *Outcome trails in the index population are lacking*
Adrenal Suppression?

- Prospective evaluation of adrenal function in 31 ED patients receiving etomidate or midazolam for RSI
- Assessed at 4/12/24 hours:
  - Cosyntropin stimulation test [CST]
  - Serum cortisol levels

Adrenal Suppression?

Results:

- 4-hr CST abnormal in 70% of patients receiving etomidate
- 12/24-hr CST normal and did not differ
- Serum cortisol levels in the normal range at every interval in both groups

Etomidate In Sepsis?

Upside:
- “Ideal” hemodynamic profile
- Predictable onset, effect, elimination

Downside:
- Risk probably not zero. Options:
  - Change nothing
  - Monitor adrenal function
  - Administer steroids empirically
Succinylcholine

- Remains the drug of choice for the ED
- Intubation level paralysis in **45 sec**
- Clinical duration **6-8 min**
- The dark side:
  - Fatal hyperkalemic risk
  - Bradycardia [children, 2nd dose]
  - Malignant hyperthermia
Risk In Renal Failure?

Studies in adults & children with known renal failure and K$^+$ above 5.5 mg/kg:

- Mean increase in K$^+$ < 0.5 mEq/L
- No dysrhythmia or other adverse effect
- So… not recommended but generally safe if renal failure is unrecognized

Fatal Hyperkalemic Risk

**Receptor Upregulation**
- Burns, crush
- Prolonged ICU stay
- UMN [eg: stroke]
- LMN [eg: SC injury]

**Myopathic Process**
- Muscular dystrophy
- Rare idiopathic

Mortality 11%

Mortality 30%

Gronert GA. *Anesthesiology* 2001; 94:523.
Rocuronium

At a dose of 1.0 mg/kg:
- 95% of patients ready in 60 seconds
- Success rate comparable to SCH
- Average duration of action 45 minutes

RSI Paralytic Agents

Fundamental Question…

Is The Patient At Risk For An Important Succinylcholine-Related Complication?

NO

Succinylcholine 1.5 mg/kg

YES

Rocuronium 1.0 mg/kg
Take Home Essentials

#1: First do no harm
#2: 5 drugs more complicated than 3
#3: Very limited ED outcome data
#4: Careful pretreatment if indicated
#5: Induction agent selection crucial
#6: State-of-the-art care saves lives
Questions?
gibbsm@mmc.org