Rapid Sequence Intubation (RSI)

OVERVIEW Rapid sequence intubation (RSI) is an airway management technique that produces inducing immediate unresponsiveness (induction agent) and muscular relaxation (neuromuscular blocking agent) and is the fastest and most effective means of controlling the emergency airway. The cessation of spontaneous ventilation involves considerable risk if the provider does not intubate or ventilate the patient in a timely manner. RSI is useful in the patient with an intact gag reflex, a “full” stomach, and a life threatening injury or illness requiring immediate airway control.

INDICATIONS FOR INTUBATION AND MECHANICAL VENTILATION
1. Airway protection and patency
2. Respiratory failure (hypercapnic or hypoxic), increased FRC, decrease WOB, secretion management/ pulmonary toilet, to facilitate bronchoscopy
3. Minimize oxygen consumption and optimize oxygen delivery (e.g. sepsis)
4. Unresponsive to pain, terminate seizure, prevent secondary brain injury
5. Temperature control (e.g. serotonin syndrome)
6. Humanitarian reasons (e.g. procedures) and for safety during transport (e.g. psychosis)

<table>
<thead>
<tr>
<th>Pro</th>
<th>Con</th>
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<tbody>
<tr>
<td>Lack of airway protection despite patency</td>
<td>Anesthetist available</td>
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<td>Hypoxia</td>
<td>Anatomically or pathologically difficult airway</td>
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<td>Hypoventilation</td>
<td>Pediatric cases (especially &lt;5 years of age)</td>
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<td>Neuroprotection (i.e. target PaCO2 35-40 mmHg)</td>
<td>Hostile environment</td>
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<td>Impending obstruction (i.e. airway burn, penetrating neck injury)</td>
<td>Poorly functioning / staffed team</td>
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<td>Prolonged transfer</td>
<td>Lack of requisite skills among team</td>
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<td>Combative</td>
<td>Emergency surgical airway not possible (e.g. neck trauma, tumor)</td>
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<td>Humanitarian (i.e. requiring multiple interventions)</td>
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<td>Cervical spine injury (diaphragmatic paralysis)</td>
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FACTORS THAT MAKE EMERGENCY INTUBATION DIFFICULT *(Airwaycam.com; Richard Levitan)* RSI if the following present:
- Dynamically deteriorating clinical situation
- Uncooperative patient
- Respiratory and ventilatory compromise
- Impaired oxygenation
- Full stomach (risk of vomiting, aspiration)
- Short “safe apnea” times
- Secretions, blood, vomitus, and distorted anatomy
RSI PROCESS ~ 9 (or 10) Ps
Minimize instrumentation and suctioning prior to intubation to avoid stimulation of the gag reflex.

1. Plan
2. Preparation (drugs, equipment, people, place)
3. Protect the cervical spine
4. Positioning
5. Preoxygenation
6. Pretreatment (i.e. atropine, fentanyl and lidocaine)
7. Paralysis and Induction
8. Placement with proof
9. Postintubation management
10. Pressure on cricoid (optional)
TEAM ROLES DURING RSI

- Minimum of 3: Airway Proceduralist, Airway Assistant, Drug administrator
- Preparation requires control over: Self, Patient, Others, Environment
- Maintain a ‘sterile cockpit environment’ when communicating the airway plan to the team, ideally through use of a ‘call and response’ checklist—otherwise one of these two mnemonics will help: **SOAPME / O2 MARBLES**

- **Suction**: at least one working suction, place it between mattress and bed
- **Oxygen**: NRBM and BVM attached to O2 15LPM, with nasal prongs for apneic oxygenation
- **Airways**: 7.5 ETT (most adults), 7.0 (smaller females), 8.0 (larger males). Test balloon
  Stylet: lubricated, placed inside ETT for rigidity, bent 30 degrees at proximal end of cuff
  Blade: Videoscope should be primary, followed by Mac 3 or 4, Miller 3 or 4 (adults)
  Handle: Attach blade and make sure light source works
  Backups: Surgical cric kit, alternative video laryngoscope, LMA and bougie at bedside
- **Pre-oxygenate**: 15 LPM NRBM
- **Monitoring equipment / Medications**: Cardiac monitor, pulse ox, BP cuff opposite arm with IV, Medications drawn up and ready to be given
- **End Tidal CO2**

O2 MARBLES is an alternative for the equipment and planning:

- Oxygen
- Masks (NP, NRB, BVM); monitoring
- Airway adjuncts (e.g. OPA, NPA, LMA); Ask for help and difficult airway trolley
- RSI drugs; Resus drugs
- BVM; Bougie
- Laryngoscopes; LMA
- ETTs; ETCO2
- Suction; State Plan
DRUG DOSAGES FOR RSI
Doses shown are for IV / IO administration. IBW = ideal body weight, TBW = total body weight
Doses may need to be adjusted in the hypotensive patient.

Premedication Agents
- Atropine 20 mcg/kg IV: prevent bradycardia in children
- Lidocaine 1.5mg/kg IV: sympatholytic, neuroprotection in head injury; decrease airway reactivity in asthma
- Fentanyl 2-3 mcg/kg IV: sympatholytic, neuroprotection in head injury and vascular emergencies (e.g. myocardial ischemia, aortic dissection, subarachnoid hemorrhage)
- Defasciculating dose of a non-depolarizing neuromuscular blocker (i.e. rocuronium 0.1 mg/kg IV or vecuronium 0.01 mg/kg IV): prevents fasciculations from succinylcholine (e.g. TBI)

Induction Agents
The ideal induction agent smoothly and quickly render the patient unconscious, unresponsive and amnestic in one arm/heart/brain circulation time, provide analgesia, maintain stable cerebral perfusion pressure and cardiovascular hemodynamics, be immediately reversible and have few, if any, side effects.
- Ketamine
  - Dose: 1.5 mg/kg IV (4mg/kg IM)
  - Onset: 60-90 sec
  - Duration: 10-20 min
  - Use: any RSI, especially if hemodynamically unstable (does not increase ICP despite traditional dogma) or if reactive airways disease (causes bronchodilation)
  - Drawbacks: increased secretions, caution in cardiovascular disease (hypertension, tachycardia), laryngospasm (rare), raised intra-ocular pressure
- Etomidate 0.3-0.4 mg/kg TBW
  - Onset: 10-15 seconds
  - Use: suitable for most situations including haemodynamically unstable, other than sepsis or seizures
  - Drawbacks: adrenal suppression, myoclonus, pain on injection,
- Fentanyl
  - Dose IV 2-10 mcg/kg TBW
  - Onset: <60 seconds (maximal at ~5 min)
  - Duration: dose dependent (30 minutes for 1-2 mcg/kg, 6h for 100 mcg/kg)
  - Use: low dose as a sympatholytic premedication (e.g. TBI, SAH, vascular emergencies); may used in modified RSI approach in low doses or titrated to effect in cardiogenic shock and other hemodynamically unstable conditions
  - Drawbacks: respiratory depression, apnea, hypotension, slow onset, nausea and vomiting, muscular rigidity in high induction doses, bradycardia, tissue saturation at high doses
- Midazolam
- Dose: 0.3mg/kg IV TBW
- Onset: 60-90 sec
- Duration: 15-30 min
- Use: not usually recommended for RSI, some practitioners use low doses of midazolam and fentanyl for RSI of shocked patients
- Drawbacks: respiratory depression, apnea, hypotension, paradoxical agitation, slow onset, variable response

- Propofol
  - 1-2.5 mg/kg IBW + (0.4 x TBW) or 1.5 mg/kg x TBW
  - Onset: 15-45 seconds
  - Duration: 5 – 10 minutes
  - Use: Hemodynamically stable patients, reactive airways disease, status epilepticus
  - Drawbacks: hypotension, myocardial depression, reduced cerebral perfusion, pain on injection, variable response, very short acting

**Neuromuscular Blockers**

- Succinylcholine
  - Dose: 1.5 mg/kg IV (2 mg/kg IV if myasthenia gravis), 4 mg/kg IM (in extremis)
  - Onset: 45-60 seconds
  - Duration: 6-10 minutes
  - Use: ideal if need to extubate rapidly following an elective procedure or to assess neurology in an intubated patient
  - Drawbacks: numerous contra-indications (hyperkalemia, malignant hyperthermia, >5d after burns/ crush injury/ neuromuscular disorder), bradycardia (especially after repeat doses), hyperkalemia, fasciculations, elevated intra-ocular pressure, will not wear off fast enough to prevent harm in CICV situations

- Rocuronium
  - Dose: 1.2 mg/kg IV IBW
  - Onset: 60 seconds
  - Use: can be used for any RSI unless contra-indication or require rapid recovery for extubation after elective procedure or neurological assessment; ensures persistent ideal conditions in CICV situation (i.e. immobile patient for cricothyroidotomy) – can be reversed by sugammadex
  - Drawbacks: allergy (Rare)

- Vecuronium
  - Dose: 0.15 mg/kg IV (may precede by a 0.01 mg/kg IV priming dose 3 minutes earlier)
  - Onset: 120-180 seconds
  - Duration: 45-60 minutes
  - Use: RSI, can be reversed by sugammadex
  - Drawbacks: allergy (rare), slow onset, long duration
**Default Strategy for Failed RSI in Adults**

**Plan A:**
Initial tracheal intubation plan
- Initial direct laryngoscopy
  - Maximum 2 attempts in 2 mins
  - Re-oxygenate if SpO₂ < 90% with 2 person BVM + OPA + NPA
  - Call Anaesthetics if Plan A fails (ext: 3186)

**Plan B:**
Secondary tracheal intubation plan
- Video laryngoscopy
  - As difficult airway, maximise laryngeal view by avoiding cricoid pressure and by using External Laryngeal Manipulation
  - Maximum 2 attempts in 2 mins
  - Re-oxygenate if SpO₂ < 90% with 2 person BVM + OPA + NPA

**Plan C:**
Maintenance of oxygenation/ventilation
- LMA
  - Avoid cricoid pressure
  - Improved oxygenation
  - Maximum 2 attempts in 2 mins
  - Plan D if SpO₂ < 75%

**Plan D:**
Rescue techniques for “can’t intubate can’t ventilate” situation
- Scalpel/ finger/ tube cricothyroidotomy

**RSI Checklist**
- Pre-oxygenate
- Position: “ear to sternal notch” - “RAMP” if obese
- Paralysis & sedation for all
- Cricoid pressure for all initially but release if poor view and apply External Laryngeal Manipulation
- Bougie for all

**Succeed**
- Tracheal intubation
- Verify with ETCO₂

**Fail**
- Tracheal intubation
- Verify with ETCO₂

**Contact Anaesthetics (ext: _____) for Fibreoptic Intubation**
Excellent Links and References

- Website: Life in the Fast Lane: WWW.LITFL.com
  - Amazing resource for critical care and emergency medicine clinicians
  - Check out: Pediatric Rapid Sequence Intubation, Preoxygenation, Intubation, Hypotension and Shock, Difficult Airway Algorithms, Direct Laryngoscopy, Cricoid Pressure
- Webinar: http://www.ashpmedia.org/connect/table/webinars_full.html - RSI
- Webinar: EM Lyceum
  - Rapid Sequence Intubation, Episode 1 and RSI Episode 2: Induction, “Answers”
- Websites: Airwayworld.com and Airwaycam.com
  - Nothing better on the internet for airway resources
- Website: ALIEM (Academic Life in Emergency Medicine)
  - Paucis Verbis card: Rapid Sequence Intubation card
- Course: Difficult Airway Course
  - Expensive but good, covers basics as well as “trick shots”, has prehospital, hospital and anesthesia-specific courses
  - Has airway cards for purchase – very helpful
- Journal articles