

PEM GUIDE: RAPID SEQUENCE INTUBATION

INTRODUCTION (MICHAEL MOJICA M.D., 5/2014)

Rapid sequence intubation (RSI) is defined as the use of a sedative and a paralytic to facilitate endotracheal intubation through muscle relaxation and improved airway visualization. RSI also reduces the potential side effects of intubation.

PROCEDURE OVERVIEW	
Preparation	Patient Selection - directed history and physical (AMPLE)
	Equipment selection and preparation
	Medication selection and preparation
Preoxygenation	High flow oxygen via nasal cannula <u>and</u> face mask if spontaneously breathing, BVM ventilation if not
Pretreatment	Premedication and sedative delivery
Paralysis	Depolarizing or non-depolarizing muscle relaxant
Positioning	"Sniffing" position (if no c-spine injury concerns)
Placement with proof	Endotracheal intubation
	Confirmation of Endotracheal tube placement
Post intubation	Maintenance ventilation, sedation, paralysis

PREPARATION - PATIENT SELECTION

Directed history and physical examination

The aim is to answer the following questions:

Is there: an indication for intubation? An indication for rapid sequence intubation?

Are there any contraindications?

Is this patient going to be difficult to ventilate?

Is this patient going to be difficult to intubate?

What are my difficult airway options? (See PEM Guide – Difficult Airway)

DIRECTED HISTORY: AMPLE	
Allergies	Egg and/or soy allergy may preclude propofol use
Medications	Medications metabolized by the cytochrome P450 enzyme pathway, (e.g. anticonvulsants and psychotropic medications) May interfere with pharmacokinetics of some sedatives
Past medical history	Relevant hospitalizations Prior sedation or anesthesia-related adverse events Patient/family history – anesthesia complications
Last meal	Timing, contents (liquids, solids)
Existing medical status	Conditions predisposing to airway obstruction or pulmonary compromise Pregnancy status Vital signs

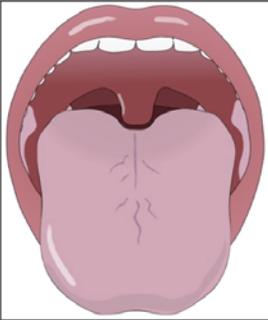
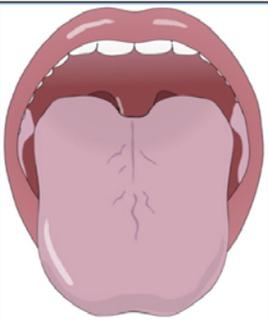
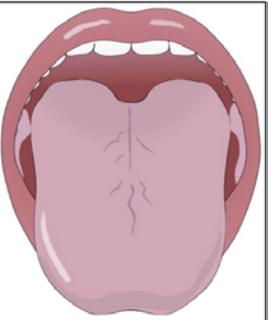
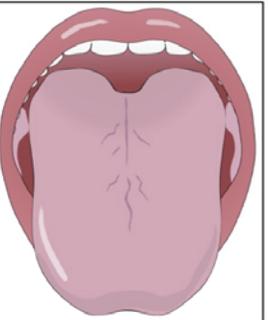
AMERICAN SOCIETY OF ANESTHESIOLOGISTS (ASA CLASSIFICATION)

I	A normal, healthy patient
II	Mild systemic disease (no functional limitation)
III	Moderate or severe systemic disease that limits activity but is not incapacitating
IV	An incapacitating systemic disease that is a constant threat to life
V	A moribund patient, not expected to survive 24 hours with/without the procedure

Physical Examination – The primary focus of the head and neck exam is to determine likelihood of a difficult ventilation or intubation. This includes the oral cavity (fracture, instability, obstruction, foreign body) and neck (mass, swelling, trauma, mobility). Abnormalities in vital signs such as hypotension may restrict medication selection.

The Mallampati classification is used to predict the ease of intubation. A high Mallampati Score (3 or above) is associated with a more difficult intubation. The score is determined with patient sitting up with their jaw thrust forward, tongue protruded and without phonation. The score is of limited use, as it can't be obtained in the two most common indications for emergency intubation: head trauma and status epilepticus

MALLAMPATI CLASSIFICATION

			
1	2	3	4
Anterior Pillars Posterior Pillars Fauces Uvula Soft Palate	Posterior Pillar Fauces Uvula Soft Palate	Uvula (base only) Soft Palate	

INDICATIONS

Patient undergoing emergent intubation especially those at risk of complications.

1. Head trauma - suspected increased intracranial pressure
 2. Aspiration risk - full stomach, pregnant, altered mental status
 3. Suspected cervical spine injury
 4. Respiratory failure
 5. Inadequate muscle relaxation - awake, seizures
 6. An agitated, combative patient requiring further work-up or treatment
- In patients that are unconscious and have no muscle tone, RSI may not be necessary, particularly in the situation of cardiopulmonary arrest.

CONTRAINDICATIONS

1. RSI should not be used in patients that have difficult airway access, as the patients will be paralyzed and unable to ventilate themselves if intubation should be unsuccessful. (See PEM Guide – Difficult Airway)
2. Known allergy to any of the agents used

PREPARATION – EQUIPMENT SELECTION

EQUIPMENT FOR RSI - "SOAPME" MNEMONIC		
S	Suction	A variety of types should be available including a tonsillar tip and different sized tracheal suction catheters
O	Oxygen	Pre-oxygenating the patient with 100% O ₂ will increase the amount of time available for the clinician to intubate the patient before hypoxemia develops (Safe Apnea)
A	Airway	Age appropriate equipment of such as; laryngoscope handles and blades, endotracheal tubes, stylets, oral airways, and ventilation bags should be readily available. Rescue equipment should be available in case fails (laryngeal mask airways, video laryngoscopes, cricothyrotomy equipment, bougie)
P	Pharmacology	The common medications used in RSI will be discussed below. Ideally, medications should be drawn up and ready to use. A weight based dosing system should be available to reduce the potential for errors.
ME	Monitoring Equipment	A cardiac monitor and pulse oximeter are mandatory when performing RSI. Frequent blood pressure checks should also be performed. Once the tube is in place, secondary confirmation with a capnometer (qualitative or quantitative) for end tidal CO ₂ measurement) should be obtained.

PREOXYGENATION

Preoxygenation with 100% FiO₂ will result in 95% nitrogen washout within 2 min. (operating room data). This provides an oxygen reserve of 3-4 minutes of apnea without hypoxia. This is marginally effective in the patient who is ill prior to intubation. It also precludes the need for bag-valve-mask ventilation.

Warm (35-37 C) and humidified high flow nasal oxygen (HHFNC) is better tolerated than non-humidified oxygen. It can open the soft palate separating it from the posterior pharyngeal wall and provide an oxygen reservoir in the nasopharynx. When used in conjunction with a non-rebreather facemask (both a 15 liters/min in adults) it can increase the fraction of inspired oxygen (FiO₂) to 100%.

Infants – start 2-4 liters/minute, increase to 8 liters/minute.

Adults – start 15 liters/minute increase to 40 liters/minute.

PREMEDICATION - MEDICATION SELECTION

1. Avoid physiologic response to intubation
2. Avoid potential adverse effects of sedatives and paralytics

LIDOCAINE	
Class	Local airway anesthetic
Benefits	Blunts cough reflex, blunts increases in HR, BP May blunt increase in ICP
Indications	Head trauma
Dose	1.5 - 3.0 mg/kg 3 minutes prior to paralytic
Comment	Used traditional in head trauma though effect on intracranial pressure in conjunction with other neuroprotective medications such as Etomidate is unclear.

ATROPINE	
Class	Anticholinergic
Benefits	Decreases airway secretions Mitigates bradycardia
Adverse Effects	Tachycardia
Indications	< 1 year 1-5 years if receiving Succinylcholine
Dose	0.01-0.02 mg/kg IV
Comment	Atropine is no longer recommended as a routine premedication in children (AHA 2015). It may be considered if there is a high risk of bradycardia (e.g. Using Succinylcholine). A minimum dose of 0.1 mg is also no longer recommended.

SEDATIVE SELECTION

SEDATIVE SELECTION			
SEDATIVE	HEAD TRAUMA	CARDIOVASCULAR DEPRESSION	MISCELLANEOUS
Etomidate	YES	YES	No - Septic shock
Ketamine	YES	YES	Yes - Asthma
Propofol	YES	NO	Yes - Seizure

KETAMINE	
Class	Pencyclidine derivative, dissociative agent
Pharmacology	Onset 1-2 minutes, Duration 10-30 minutes
Benefits	Rapid onset, amnestic, analgesic Sympathomimetic activity, bronchodilation
Adverse Effects	Laryngospasm (reverse with a paralytic) Increased airway secretions (Premedicate Atropine) Increased ICP but overall effect may be neuroprotective Exacerbates psychosis
Indications	Status asthmaticus Injured patient Mild hypovolemic shock
Contraindications	Catecholamine depletion: The unopposed direct negative inotropic effects of ketamine may lead to cardio-vascular compromise.
Dose	1-2 mg/kg IV
Comment	Previously thought to increase intraocular and intracranial pressure but recently found to be untrue

ETOMIDATE	
Class	Imidazole sedative hypnotic
Pharmacology	Onset – 1 minute, Duration 3-12 minutes
Benefits	Cardiovascular stability, decreases ICP
Adverse Effects	Transient cortisol depression, myoclonic activity
Indications	Head trauma
Contraindications	Adrenal insufficiency, chronic steroid use PALS recommends to avoid use in septic shock
Dose	0.3 – 0.4 mg/kg
Comment	Reduces cortisol production but clinical significance with a single dose for rapid sequence intubation is unclear

PROPOFOL	
Class	Sedative-hypnotic
Pharmacology	Onset 30-60 seconds, Duration 10-15 minutes
Benefits	Titratable, decreases ICP
Adverse Effects	Cardiovascular depression - hypotension Medical acidosis in children with prolonged use
Indications	Precise controlled sedation
Contraindications	Hypotension
Dose	Bolus 0.5 – 1.0 mg/kg, Infusion 0.05 - 0.10 mg/kg/min

PARALYSIS - PARALYTIC SELECTION

There is two very commonly used paralytic drugs: succinylcholine, a depolarizing muscle relaxant, and rocuronium, a nondepolarizing agent. Vecuronium (0.1 – 0.2 mg /kg) may be substituted for rocuronium at some institutions.

SUCCINYLBCHOLINE	
Class	Depolarizing muscle relaxant
Pharmacology	Onset 30-60 seconds, duration 10-15 minutes
Benefits	Short onset and duration
Adverse Effects	<u>Nicotinic effects</u> - muscle fasciculations - minimal < 5 years May increase ICP, IOP, hyperkalemia <u>Muscarinic effects</u> - increases secretions, bradycardia, cardiovascular depression, dysrhythmias <u>Malignant hypothermia</u> - 1:15:000, Rx Dantroline
Contraindications	Cholinesterase deficiency, muscular dystrophy Family history malignant hyperthermia Hyperkalemia, late crush injuries, burns (not initial presentation) Relative - increased ICP, IOP
Dose	Infant - 2.0 mg/kg, Child/Adult - 1.0mg/kg

ROCURONIUM	
Class	Non-depolarizing muscle relaxant
Pharmacology	Onset 40-60 seconds, duration 60-90 minutes
Benefits	Short onset and duration
Dose	0.6 - 1.0 mg/kg IV

POSITIONING

The sniffing position allows for optimal visualization of the glottic opening. It is achieved by elevating the patient's head and extending the head at the atlanto-occipital joint. Positioning of the neck should not be used in patients at risk for cervical spine injury.



PLACEMENT WITH PROOF

Endotracheal intubation (see PEM Guide – Endotracheal Intubation)

Confirmation of Endotracheal tube placement

- Direct visualization of tube passing through cords
- Auscultation of lung fields and over stomach
- End-tidal CO₂ monitor – colorimetric or continuous
- Chest XRAY

CRICOID PRESSURE (Sellick maneuver)

Evidence shows that cricoid pressure does not occlude the esophagus (90% slip to side) and may worsen airway visualization. No longer recommended by American Heart Association for cardiac arrest.

POST INTUBATION

Maintenance ventilation

Maintenance sedation and paralysis

RESCUE AIRWAY PROCEDURES

If attempts at bag valve mask ventilation and endotracheal intubation fail additional techniques could be utilized to provide a definitive airway. These techniques include the supraglottic airways such as the laryngeal mask airway, fiberoptic intubation cricothyrotomy. Equipment and personnel trained in these techniques should be readily available if rapid sequence intubation is to be attempted. (See PEM Guide: Procedure: Difficult Airway, PEM Guide: Procedure: Cricothyrotomy)