*Advanced Emergency Nursing Journal*
Vol. 40, No. 3, pp. 183–193


# PROCEDURAL COLUMN

**Column Editor: Jennifer Wilbeck, DNP, RN, FNP-BC, ACNP-BC, ENP-C, FAANP**

# Maximizing Success With Rapid Sequence Intubations

***Tony L. Smith, DNP, RN, ACNP-BC, FNP-BC, CCRN, CFRN, EMT-P***
***Jessica Van Meter, DNP, RN, ANP-BC, CCRN, AEMT***

**ABSTRACT**
Within emergency care settings, rapid sequence intubation (RSI) is frequently used to secure a definitive airway (i.e., endotracheal tube) to provide optimal oxygenation and ventilation in critically ill patients of all ages. For providers in these settings, a deeper understanding of the indications, associated medications, and adjunctive techniques may maximize success with this common procedure. Identification of difficult airways, using mnemonics and standardized criteria prior to the procedure allows, the clinician additional time for assimilation of additional resources and tools to increase the likelihood of first-pass success with intubation. This article describes tools for the procedure of RSI, including the "7 Ps" checklist of intubation. **Key words:** airway, intubation, rapid sequence intubation, RSI, video laryngoscopy

GIVEN the unpredictable nature of trauma and medical emergencies, providers in emergency care settings must be prepared to perform lifesaving procedures. One such procedure is rapid sequence intubation (RSI), in which a definitive airway is established using an endotracheal (ET) tube to provide optimal oxygenation and ventilation in critically ill patients of all ages. Airway management during RSI utilizes sequenced medication administration to facilitate ET tube intubation, ultimately producing immediate unresponsiveness (via an induction agent) and muscular relaxation (using a neuromuscular blocking agent). For providers in these settings, a deeper understanding of the indications, associated medications, and adjunctive techniques may maximize success with this common procedure. Identification of difficult airways using mnemonics and standardized criteria prior to the procedure allows the clinician additional time for assimilation of additional resources and tools to increase the likelihood of first-pass success with intubation. For intubations in the emergency department, there are increased adverse events when the intubation is unsuccessful on the first attempt (Sakles, Chiu, Mosier, Walker, & Stolz, 2013). Tools and a checklist for the

***Author Affiliation:*** *Vanderbilt LifeFlight, Vanderbilt School of Nursing, Vanderbilt University Medical Center, Nashville, Tennessee.*

***Disclosure:*** *The authors report no conflicts of interest.*

***Corresponding Author:*** *Tony L. Smith, DNP, RN, ACNP-BC, FNP-BC, CCRN, CFRN, EMT-P, Vanderbilt LifeFlight, 1211 Medical Center Dr, Skyport Helipad-VUH 13200, Nashville, TN 37232 (tony.smith@vanderbilt.edu).*

*DOI: 10.1097/TME.0000000000000204*

procedure of RSI, including the "7 Ps" checklist outlined in Appendix A, offer a systematic approach to each step of RSI and increase the likelihood of provider success of first attempt (Hatch et al., 2016).

To most appropriately prepare for the procedure of RSI, the clinician must:

1. Identify which patients are appropriate for RSI;
2. Identify potentially difficult airways based on physical assessment;
3. Understand the mechanisms of action and expected outcomes of pharmacological agents used during RSI;
4. Be familiar with RSI equipment; and
5. Develop and be able to implement an alternate/contingency plan (the "7 Ps" of RSI).

In an emergency, RSI offers the fastest and most effective means of controlling an unsecure, nonpatent airway. However, the cessation of spontaneous ventilation involves considerable risk if the provider does not intubate or ventilate the patient in a timely manner (Sakles et al., 2013). Rapid sequence intubation is particularly useful in the patient with an intact gag reflex, a "full" stomach, and a life-threatening injury or illness requiring immediate airway control.

Typically, RSI is utilized in patients demonstrating signs/symptoms of impending respiratory failure or arrest who will require mechanical ventilation (e.g., hypoxia, dyspnea, hypercapnia, and/or decreased level of consciousness or unresponsiveness) (National Heart, Lung, and Blood Institute, 2018). The presence of severe acidosis, depletion of intravascular volume, heart failure, and severe pulmonary disease may complicate the preinduction period. In these cases, induction can lead to a severely detrimental onset of vasodilatation, resulting in profound, and often deadly, hypotension. In addition, hypoxemia is another severe complication that can arise during execution of RSI (Burns, Habig, Eason, & Ware, 2016).

## IDENTIFICATION OF DIFFICULT AIRWAY

Before the airway can be managed, it must be properly assessed to ensure that whatever level of intervention is applied, it can be most successful. All providers need to be able to predict the possibility of a difficult airway because their management approach may require modifications from standard procedures (Brocato, 2010). In addition to an "across-the-room" assessment, which may allow clinicians to quickly categorize the patient's condition as life-threatening versus non-life-threatening, it also serves to motivate the clinician toward the most direct treatment and rapid initiation of interventions without delay (Dieckmann, Brownstein, & Gausche-Hill, 2010). Simply performing a visual inspection of the patient allows the provider to assess for the following possibilities: obesity, a short or widened neck, and/or obvious signs of distorted anatomy. If any of these conditions are identified, then providers should anticipate a difficult airway intubation.

## THE 3-3-2 RULE

The 3-3-2 rule is a rapid assessment tool to assist the provider in identifying a difficult airway and intubation. Examining the patient's airway using the 3-3-2 rule is accomplished using three measurements: three vertical fingers to measure the distance between the upper and lower incisors for the maximal opening of the mouth; thyromental distance three-finger breaths between the tip of the chin (mentum) to the tip of the thyroid cartilage (less than 6 cm or three-finger breath suggests RSI may be difficult); and finally, two-finger breaths between the hyoid bone and the thyroid notch, suggesting the difficulty of intubation is low (Hung & Murphy, 2017; Mahmoodpoor et al., 2013). In a patient with any single measurement less than the 3-3-2 rule, the clinician should anticipate a difficult airway, as there may not be enough space with which to introduce the appropriate tools, increased inability to control the tongue, or the potential for an anterior larynx.

## THE MALLAMPATI SCORE

The Mallampati score estimates the size of the tongue in relation to the oral cavity to identify the ease or difficulty of displacement of the tongue by the laryngoscope blade and ease of the patient opening the mouth (Mallampati et al., 1985). With the patient sitting upright, the clinician asks the patient to open his or her mouth as wide as possible with the tongue protruding. The clinician assigns a score based on structures visualized (Mallampati et al., 1985).

There are four classifications, numbered Mallampati 1–4, with 1 describing the most amount of space and 4 being the least. With Class 1, the clinician will have complete visualization of the soft palate. With Class 2, the clinician will have complete visualization of the uvula. Class 3 scoring indicates the clinician will have visualization of only the base of the uvula. With Class 4, the soft palate is not visible at all (Mallampati et al., 1985). Figure 1 demonstrates the oropharyngeal structures visualized for each Mallampati classification that the provider may see when looking into the patient's mouth.

## MNEMONIC TO ASSESS DIFFICULT AIRWAYS

To help in rapid assessment during RSI, the mnemonic **LEMON** can assist the clinician in predicting a difficult airway during direct laryngoscopy.

- **L:** "Look externally," where the clinician observes for external signs, that is, active bleeding from the mouth, facial disruption, small mouth, or trismus.
- **E:** "Evaluate 3-3-2 rule" as described earlier.
- **M:** "Mallampati," a determination of the Mallampati score as described earlier.
- **O:** "Obstruction," where the provider will assess for foreign objects in the mouth (i.e., vomitus, blood, tongue), tumors/abscess, or expanding hematomas.
- **N:** "Neck mobility," here, if possible, the provider will have the patient place his or her chin to chest.

In cases of suspected cervical spine injuries, the patient will not be able to perform this maneuver and therefore this can be a predicative of less than optimal RSI attempt (Hung & Murphy, 2017).

## PHARMACOLOGY OF RSI

Once the need for RSI is identified and the patient has been evaluated, medications most safely and effectively used for the patient must be identified. Understanding and having an appreciation for each medication's mechanism of action during RSI is essential, as it can often make the difference between being successful and having a failed airway attempt. Although there are several medications and regimens that can be used in RSI, the classes of medications commonly used include the following: antiparasympathetic blocker,

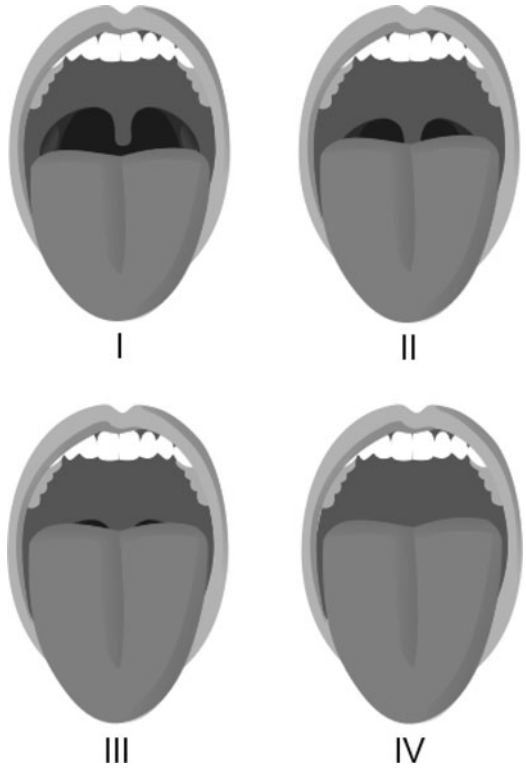


**Figure 1.** Mallampati scoring. Photo credit: Jmarchn—Own work, CC BY-SA 3.0. Retrieved from https://commons.wikimedia.org/w/index.php?curid=12842847

sedation and analgesia, depolarizing paralytic, and nonpolarizing paralytic (Campo & Lafferty, 2015).

Because laryngoscopy during RSI can lead to episodic bradycardia, it was once standard to administer an anti-parasympathetic blocker, such as atropine, at the onset of RSI. This adjunctive medication, however, is used less frequently now within the adult population, as the bradycardia is typically transient and not likely to be hemodynamically significant (Fox, 2014). Atropine is still indicated in the RSI of pediatric patients, specifically those younger than 12 months, in an attempt to avoid reflex bradycardia during laryngoscopy (de Caen et al., 2015).

Sedation and analgesia prior to intubation are typically achieved with etomidate (Amidate), ketamine (Ketalar), midazolam (Versed), or fentanyl (Sublimaze). Propofol (Diprivan) is the most commonly used intravenous hypnotic, but because of potential for significant hypotension, it requires a normotensive patient (Jager, Aldag, & Deshpande, 2015). In hypotensive patients, ketamine represents a viable alternative. Depolarizing paralytics, such as succinylcholine (Anectine), provide muscle relaxation that assists in insertion of the ET tube. Succinylcholine must be used cautiously in patients for whom hyperkalemia is either present or possible as this drug can elevate potassium to lethal levels (Thomson Micromedex, 2018).

Nondepolarizing neuromuscular blocking agents, the most common of which is rocuronium (Zemuron), are an alternative to succinylcholine. Rocuronium is characterized by a rapid onset (1–2 min) and an intermediate half-life (45–70 min). The onset depends on the dosage used. A relatively safe drug, rocuronium's most limiting factor in use during RSI is that its duration of action is much longer than that of succinylcholine, especially when used at higher doses. Should procedural complications result in the need for a reversal agent, sugammadex (Bridion) is available and acts as a muscle relaxant, thereby antagonizing the effects induced by rocuronium on muscle tissue quickly resolving the neuromuscular blockade (Di Filippo & Gonnelli, 2009; Driver et al., 2017). Medications frequently used in conjunction with RSI are summarized in Appendix B.

## PROCEDURE

Prior to the procedure, a TIME OUT should be performed to make sure all team members who will be present during the RSI are aware and acknowledge the plan. Specific equipment is required for the procedure, and the clinician must be familiar with all equipment before attempting RSI. The two larger pieces of equipment required include a functional suction unit with a Yankauer suction tip and a laryngoscope, either traditional or video. The traditional laryngoscope consists of an operational handle, operational blades (Miller straight blade and Macintosh curve blade), and bulbs. Both styles of blades come in five sizes (0–2 primarily for pediatrics and 3–4 primarily for adults). The video laryngoscope consists of a handle with a small camera to provide an image of the vocal cords and laryngeal tissue on a display. Steps to the procedure can be recalled using the "7 Ps", a checklist addressing each step for the RSI. The 7 Ps are preparation, preoxygenation, pretreatment, paralysis for induction, protection (for the clinician and the patient), proof of placement, and postintubation management and medications.

### Preparation

As preparation sets the tone for the rest of the procedure, this is a critical first step. Vocalizing a plan, confirming each team member's duties, and preparing equipment help ensure that providers are mitigating opportunities for failure. The clinician should ensure that the following have been completed and are present:

- Assessment for possible difficult airway
- Hemodynamic monitoring to include pulse oximeter, blood pressure, cardiac rhythm, and end-tidal $CO_2$
- Functional intravenous access

- Appropriate sized bag–valve–mask (BVM)
- Suctioning equipment: Yankauer, tubing, and regulator
- Functioning laryngoscope with a blade of choice
- Endotracheal tube (man: 8-mm, woman: 7-mm internal diameter [ID]; pediatric: use length-based [Broselow tape] system or rough guide (4 plus age [in years] divided by 4), check cuff, load and shape stylet, 10-ml syringe)
- Gum elastic "Bougie" or stylet
- All RSI medications with appropriately calculated dosages should be drawn up and ready to be administered, followed by a normal saline flush
- Alternate plan if unable to correctly place the ET tube: The clinician should develop and have a secondary plan and a tertiary plan if he or she is unable to place the ET tube. This plan can include utilizing the BVM with 100% oxygen to achieve oxygen saturations of greater than 96%. In addition, another intubation attempt should include a change in the clinician, equipment, position of the patient or the clinician, or utilization of a rescue airway device.

With respect to equipment, evidence recommends the use of bougie on first attempt (Driver et al., 2017). The use of the bougie is twofold: Primarily, it is more pliable and can be formed to a specific patient, and, second, it can be used as a confirmation tool. If the bougie is inserted and continues to thread into the oral cavity without hitting a definitive stop, is likely to be in the esophagus. This simple confirmation tool then allows the clinician to pull the bougie before injecting air into the stomach via a BVM, thereby decreasing the likelihood of an aspiration event. If the bougie is inserted and stops two thirds of the way, it provides confirmation to the provider that it is against the carina and the ET tube can be advanced.

### Preoxygenation

Recent evidence support utilizing the NO DESAT (nasal oxygen [high flow] during efforts securing a tube) procedure be applied to the patient as soon as the decision to intubate has been made (Levitan, 2015). The NO DESAT procedure has become common in many areas to protect patients from inadvertent episodes of hypoxia during intubation attempts. The procedure is simple and can be initiated once the decision is made to intubate. During preoxygenation, the patient is placed on high-flow nasal cannula while utilizing a nonrebreather or BVM. Oxygen can then be passively absorbed through the nasal cannula during the procedure, thereby mitigating a potential drop in oxygen saturation during the induction phase of RSI.

### Pretreatment

Rapid sequence intubation begins with a small dose of sedation and analgesia to relax the patient, thereby avoiding exacerbation or excitation from the patient. In pediatric patients (younger than 1 year), atropine (0.02 mg/kg/dose) is used to minimize episodes of bradycardia that can occur secondary to the introduction of the laryngoscope (de Caen et al., 2015).

### Paralysis With induction

An induction agent should be given by rapid intravenous push (RIVP) prior to the paralytic. The clinician must allow enough time after administration for the induction agent to exhibit the appropriate response specific for the induction agent of choice. Induction agents utilized often are described as follows (Epocrates Plus, 2018):

- Etomidate (Amidate) 0.3 mg/kg RIVP. Monitor closely for hemodynamic affects and adrenal insufficiency 24–48 hr postinduction.
- Ketamine (Ketalar) 1.5 mg/kg RIVP. The patient may exhibit dissociative "trance-like state" nystagmus with rightward eye stare and intermittent increase in blood pressure and heart rate (HR).
- Versed 0.3 mg/kg RIVP. The patient may exhibit some hemodynamic effects such as decreased blood pressure, HR, and respiratory depression.

After the desired effects from the induction agent, a paralytic agent should be given RIVP. The choice of a depolarizing versus nondepolarizing paralytic agent is dependent on patient presentation and history. The depolarizing agent used most commonly is succinylcholine dosed at 1.5–2 mg/kg. Patients will exhibit fasciculations of the major skeletal muscles following administration, and the provider should allow time for all fasciculations to stop including paralysis of the jaw before introducing the laryngoscope blade. The clinician should avoid use of succinylcholine in patients with any of the following history: renal insufficiency or disease; burns greater than 10 hours old; crush injury; eye disease or injury; hyperkalemia; and/or history or family history of malignant hyperthermia (Epocrates Plus, 2018).

Nonpolarizing agents lead to total paralysis within 60–90 s of administration. The clinician should allow appropriate amount of time to allow for desired effects. The jaw should relax, and skeletal muscle relaxation should occur. Commonly used nonpolarizing agents include the following:

- Vecuronium (Norcuron) (0.1 mg/kg); duration: 35–40 min
- Rocuronium (1 mg/kg); duration: 25–35 min

### Protection

Protection for both the clinician and the patient should be observed at all times preprocedure, during the procedure, and postprocedure. The clinician should have on the appropriate body substance isolation. With respect to patient safety, current evidence no longer recommends the Selleck maneuver, or cricoid pressure, as the procedure does not prevent regurgitation and aspiration (Algie et al., 2015). A literature review does suggest the use of the BURP (Backward, Upward, Rightward Pressure to the thyroid cartilage) technique. BURP is an external manipulation of the larynx that assists the proceduralist in identifying the appropriate anatomical structures (Sharma, 2017).

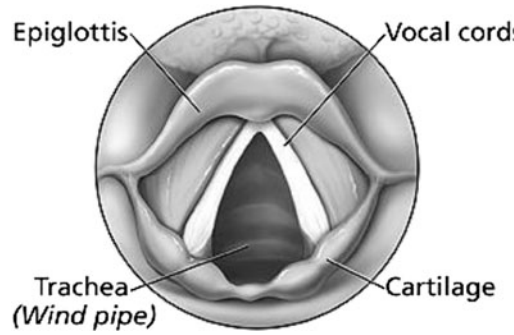


**Figure 2.** Larynx. From *Larynx*, by Wikimedia Commons, the free media repository, January 1, 2018. Retrieved May 15, 2018, from https://commons.wikimedia.org/w/index.php?title=Larynx&oldid=275837311

### Placement

Placement refers to the insertion of the ET tube with direct visualization of the anatomical landmarks for the larynx (see Figure 2). Once the ET tube is in place, air should be injected into the balloon port for stabilization. The evidence suggests injecting enough air into the ET tube cuff to maintain 20–30 cm of $H_2O$, as this avoids potential necrosis of the chords or larynx (Sole et al., 2011). After the balloon is inflated, appropriate placement is confirmed using the following techniques: end-tidal carbon dioxide per colorimetric carbon dioxide detector or quantitative capnography wave form and auscultation of the epigastrium for air or gurgle. If air/gurgle is heard, the ET tube must be removed and an alternate plan initiated. If no air is heard, then the clinician will proceed to listen for bilateral breath sounds, listening anterior and laterally on all patients. Once placement has been confirmed, the ET tube should be secured using a commercial device or tape noting the depth in terms of centimeters where the tube meets the gum line or teeth.

### Postintubation management

Once secured, a chest radiograph should be ordered for placement and anatomical location. The tip of the ET tube should be at the level of the clavicles or 5–7 cm above the

carina corresponding with the fifth and seventh thoracic vertebral bodies (Singh, Neutze, & Enterline, 2015). After confirmation and anatomical placement, long-term sedation and analgesia (e.g., midazolam and fentanyl) should be administered with a long-term paralytic if the patient condition warrants. Long-term paralytics should be avoided if the patient has any acute neurological insults such as cerebrovascular accident or seizures. The patient can then be placed on a ventilator for mechanical ventilation support.

## CONCLUSION

Although critical care patient outcomes are hardly predictable, quick recognition of airway compromise and the response of the clinician can impact those outcomes. Making the decision to utilize RSI with patients can be a stressful and daunting experience. By breaking down critical procedures into easily recalled steps with a mnemonic such as "7 Ps," utilizing a preprocedural list, using correct medications and doses, and employing a "time out," the emergency provider is positioned for a more successful procedural outcome and thus more optimal patient outcomes as well.

## REFERENCES


Algie, C. M., Mahar, R. K., Tan, H. B., Wilson, G., Mahar, P. D., & Wasiak, J. (2015). Effectiveness and risks of cricoid pressure during rapid sequence induction for endotracheal intubation. *Cochrane Database of Systematic Reviews*, (11), CD011656.

Brocato, C. (2010). Lemon-Aid: Using a mnemonic device to assess difficult airways. *The Journal of Emergency Medical Services*, *35*(3), 28–30.

Burns, B., Habig, K., Eason, H., & Ware, S. (2016). Difficult intubation factors in prehospital rapid sequence intubation by an Australian helicopter emergency medical service. *Air Medical Journal*, *35*(1), 28–32.

Campo, T. M., & Lafferty, K. A. (Eds.). (2015). *Essential procedures for emergency, urgent, and primary care settings: A clinical companion*. New York, NY: Springer.

de Caen, A. R., Berg, M. D., Chameides, L., Gooden, C. K., Hickey, R. W., Scott, H. F., . . . Samson, R. A. (2015). Part 12: Pediatric advanced life support: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*, *132*(18, Suppl. 2), S526–S542.

Di Filippo, A., & Gonnelli, C. (2009). Rapid sequence intubation: A review of recent evidences. *Reviews on Recent Clinical Trials*, *4*(3), 175–178.

Dieckmann, R. A., Brownstein, D., & Gausche-Hill, M. (2010). The pediatric assessment triangle: A novel approach for the rapid evaluation of children. *Pediatric Emergency Care*, *26*(4), 312–315.

Driver, B., Dodd, K., Klein, L. R., Buckley, R., Robinson, A., McGill, J. W., . . . Prekker, M. E. (2017). The bougie and first-pass success in the emergency department. *Annals of Emergency Medicine*, *70*(4), 473.e1–478.e1.

Epocrates Plus. (2018). *Contraindications for succinylcholine use*. Retrieved May 14, 2018, from https://www.epocrates.com

Fox, S. (2014). Pediatric EM morsels: Atropine not needed for RSI. Retrieved February 16, 2018, from http://pedemmorsels.com/atropine-needed-rsi

Hatch, L. D., Grubb, P. H., Lea, A. S., Walsh, W. F., Markham, M. H., Maynord, P. O., . . . Ely, E. W. (2016). Interventions to improve patient safety during intubation in the neonatal intensive care unit. *Pediatrics*, *138*(4), e20160069.

Hung, O., & Murphy, M. F. (2017). *Management of the difficult and failed airway*. New York, NY: The McGraw-Hill Companies, Inc.

Jager, M. D., Aldag, J. C., & Deshpande, G. G. (2015). A presedation fluid bolus does not decrease the incidence of propofol-induced hypotension in pediatric patients. *Hospital Pediatrics*, *5*(2), 85–91.

Levitan, R. (2015). *Emergency Physicians Monthly*. Retrieved February 16, 2018, from http://epmonthly.com/article/no-desat

Mahmoodpoor, A., Soleimanpour, H., Nia, K. S., Panahi, J. R., Afhami, M., Golzari, S. E., & Majani, K. (2013). Sensitivity of palm print, modified Mallampati score and 3-3-2 rule in prediction of difficult intubation. *International Journal of Preventive Medicine*, *4*(9), 1063–1069.

Mallampati, S. R., Gatt, S. P., Gugino, L. D., Desai, S. P., Waraksa, B., Freiberger, D., & Liu, P. L. (1985). A clinical sign to predict difficult tracheal intubation; A prospective study. *Canadian Anaesthetists Society Journal*, *32*(4), 429–434.

National Heart, Lung, and Blood Institute. (2018). *Respiratory failure*. Retrieved April 1, 2018, from https://www.nhlbi.nih.gov/health-topics/respiratory-failure

Sakles, J. C., Chiu, S., Mosier, J., Walker, C., & Stolz, U. (2013). The importance of first pass success when performing orotracheal intubation in the emergency department. *Academic Emergency Medicine*, *20*(1), 71–78.

Sharma, R. (2017, June). Use of backward upward rightward pressure (BURP) and optimum external laryngeal manipulation (OELM) to confirm tracheal

placement of endotracheal tubes in difficult cases. *The Journal of Emergency Medicine*, *52*(6), 883.

Singh, H., Neutze, J. A., & Enterline, J. R. (2015). Tubes and lines. In *Radiology fundamentals* (pp. 119–124). Cham, Switzerland: Springer.

Sole, M. L., Su, X., Talbert, S., Penoyer, D. A., Kalita, S., Jimenez, E., . . . Bennett, M. (2011). Evaluation of an intervention to maintain endotracheal tube cuff pressure within therapeutic range. *American Journal of Critical Care*, *20*(2), 109–118.

Thomson Micromedex. (2018, March 31). *Micromedix Healthcare Series*. Greenwood Village, CO.

Wikimedia Commons, the free media repository. (2018, January 1). *Larynx*. Retrieved May 15, 2018, from https://commons.wikimedia.org/w/index.php?title=Larynx&oldid=275837311

## **Appendix A.** Airway Checklist

☐ **Plan**
- State Decision for Procedure to all crew and all members involved.

☐ **Pre-Oxygenation/Position**
- NO DESAT Initiation (High Flow Nasal Cannula and High Flow NRB Mask)
- Proper Position (Ear/Sternal Notch, HOB 30 Degrees, C-Spine Precaution)

☐ **Prepare**
- Ensure Working PIV/IO
- Ensure Adequate $SpO_2$ >94%
- Sedative Selection
  - Why this Drug
  - Who is Administering Sedative
- Paralytic Selection
  - Why this Drug
  - Who is Administering Paralytic
- Back-Up Plan with SGA Available
- Bougie Out/Open
- Suction ON/Proper location
- BVM with PEEP and $EtCO_2$ attached
- Endotracheal tube with stylet
  - Multiple sizes available

☐ **Procedure**
- Who is Intubating
- Utilize Progressive Video Laryngoscopy (Verbalize airway structures)
- Unsuccessful first attempt, Team Reset with new strategy

☐ **Placement Confirmation**
- Video Laryngoscopy with Visualization of tube through cords
- End-Tidal $CO_2$ Wave Form
- Bilateral Breath Sounds
- Mist in tube
- Symmetric chest rise/fall

☐ **Post Management**
- Secure Tube
- Give Sedation/Analgesia/Long-Term Paralytics
- Insert OG Tube

☐ **TEAM TIME OUT**
- **Proceed with RSI**

*Note*. Checklist developed by Jason N. Reed, MSN, CEN, AEMT. BVM = bag–valve–mask; HOB = head of bed; NRB = nonrebreather mask; OG = orogastric; PEEP = positive end-expiratory pressure; PIV/IO = peripheral intravenous/intraosseous; SGA = supraglottic airway.

## **Appendix B.** Pharmacology for RSI Summary Table

| Drug | Indication | Mechanism of action | Dosage | Contraindications | Special considerations | Side effects | Interactions |
|---|---|---|---|---|---|---|---|
| Atropine | Symptomatic To prevent the reflex bradycardia that comes with laryngoscopy and intubation | Classified as an anticholinergic drug (parasympatholytic) | Pediatric RSI: 0.02 mg/kg intravenous, mini dose 0.1 mg; intramuscular dose 0.2–0.4 mg/kg<br>In cardiac uses, it works as a nonselective muscarinic acetylcholinergic antagonist, increasing firing of the sinoatrial node and conduction through the atrioventricular node of the heart, opposes the actions of the vagus nerve, blocks acetylcholine receptor sites, and decreases bronchial secretions | Contraindicated in patients hypersensitive to drug or sodium metabisulfite or narrow-angle glaucoma | With intravenous administration, drug may cause paradoxical initial bradycardia | Decreases the action of the parasympathetic nervous system, resulting in decreased secretions | Additive effects when used with other anticholinergic medications; monitor patient carefully |
| Etomidate | RSI and short procedures | Etomidate is a short-acting hypnotic that appears to have GABA-like effects | Adult RSI: 0.3–0.5 mg/kg IVP, max dose 40 mg<br>Pediatric RSI: 0.3–0.5 mg/kg intravenously; recommended dose 0.5 mg/kg; intramuscular administration not recommended | Risk–benefit should be considered with patients with immunosuppression, sepsis, or transplant. | Etomidate is a sedative-hypnotic without analgesic action | Etomidate can block the adrenal gland's production of cortisol, resulting in temporary adrenal gland failure; this may cause lowered blood pressure or shock | May increase the risk of hypotension and/or respiratory depression |
| Fentanyl | Management of pain | Binds to the opiate receptors as an agonist to alter the patient's perception of painful stimuli, thus providing analgesia for moderate to severe pain | Adult/Pediatric: 1–5 mcg/kg | Contraindicated in patients intolerant to drug; use cautiously in elderly or debilitated patients and in those with head injuries, increased CSF pressure, COPD, decreased respiratory reserve, compromised respirations, arrhythmias, or hepatic, renal, or cardiac disease | Fentanyl may cause bradycardia<br>High doses can produce muscle rigidity | CV: Hypotension, hypertension, arrhythmias, chest pain<br>Respiratory: Respiratory depression, hypoventilation, dyspnea, apnea | CNS depressants cause potential respiratory and CNS depression, sedation, and hypotensive effects of drug |

(*continues*)

**Appendix B.** Pharmacology for RSI Summary Table (*Continued*)

| Drug | Indication | Mechanism of action | Dosage | Contraindications | Special considerations | Side effects | Interactions |
|---|---|---|---|---|---|---|---|
| Ketamine | Induction for RSI, short diagnostic or surgical procedures | Induces a profound sense of dissociation from the environment by direct action on the cortex and limbic system | Adult RSI: 1–2 mg/kg intravenously<br>Pediatric RSI: 1–2 mg/kg | Ischemia (MI and CVA) or conditions where significant elevations in blood pressure would be a serious hazard | The effect of ketamine on blood pressure makes it particularly useful in hypovolemic patients as an induction agent that supports blood pressure | Hypertension<br>Emergence from anesthesia | Barbiturates, narcotics: May cause prolonged recovery time |
| Propofol | General anesthesia or sedation for mechanically ventilated patients | Short-acting hypnotic. MOA has not been well defined | Adult RSI: 2–2.5 mg/kg with maintenance of 6–12 mg/kg/hr | Allergies to eggs, soybeans, or peanuts | Must be titrated to effect and administered slowly to prevent the occurrence of adverse reactions; reduce dose in elderly, hypovolemic, and high-risk patients | Injection site pain—respiratory depression, apnea, hiccup, bronchospasm, laryngospasm, hypotension, arrhythmia, tachycardia, bradycardia, hypertension headache, dizziness, euphoria, myoclonic-clonic movement, seizures nausea, vomiting, abdominal cramps | Potentiation occurs when combined with narcotic analgesics and CNS depressants |
| Rocuronium | Indicated to facilitate rapid-sequence or routine tracheal intubation and to induce skeletal muscle relaxation during mechanical ventilation | Nondepolarizing neuromuscular blocking agent with a rapid to intermediate onset depending on dose and intermediate duration<br>It acts by competing for cholinergic receptors at the motor endplate | Adult RSI: 1–1.2 mg/kg intravenously<br>Pediatric RSI: 0.6–1.2 mg/kg | Injection is contraindicated in patients known to have hypersensitivity to rocuronium bromide | Patients who are chronically receiving anticonvulsant agents such as carbamazepine or phenytoin, shorter durations of neuromuscular block may occur due to the development of resistance to nondepolarizing muscle relaxants | Arrhythmia, abnormal electrocardiogram, tachycardia<br>Asthma, bronchospasm, wheezing, rhonchi | Resistance to neuromuscular blockade may occur with chronic phenytoin therapy, severe anaphylactic reactions to neuromuscular blocking agents<br>Rocuronium may cause histamine release |
| Succinylcholine | Succinylcholine is indicated as an adjunct, to facilitate tracheal intubation and to provide skeletal muscle relaxation during mechanical ventilation | Succinylcholine is a depolarizing skeletal muscle relaxant, as does acetylcholine; it combines with the cholinergic receptors of the motor endplate to produce depolarization | Adult RSI: 1.5–2 mg/kg IVP, max dose 200 mg; intramuscular dose is double intravenous dose<br>Pediatric RSI: 1.5–2 mg/kg | Contraindicated in persons with a personal or familial history of malignant hyperthermia, skeletal muscle myopathies, hyperkalemia, rhabdomyolysis, renal failure, increased intraocular pressure, and known hypersensitivity to the drug | No effect on consciousness, pain threshold, or cerebration. It should be used only with adequate analgesia and sedation<br>Succinylcholine causes an increase in intraocular pressure<br>Succinylcholine may cause slight increases in intracranial pressure immediately after its injection and during the fasciculation phase | Neuromuscular blockade may be prolonged in patients with hypokalemia, hypocalcemia, and organophosphate exposure | Drugs that may enhance the neuromuscular blocking action of succinylcholine include oxytocin, $\beta$-adrenergic blockers, procainamide, lidocaine, magnesium salts, metoclopramide, and terbutaline |

(*continues*)

**Appendix B.** Pharmacology for RSI Summary Table (*Continued*)

| Drug | Indication | Mechanism of action | Dosage | Contraindications | Special considerations | Side effects | Interactions |
|---|---|---|---|---|---|---|---|
| Vecuronium | Adjunct to facilitate intubation and to provide skeletal muscle relaxation during mechanical ventilation | Prevents acetylcholine from binding to receptors on the motor end plate, thus blocking depolarization | Adult RSI: 0.1–0.2 mg/kg intravenously<br>Pediatric RSI: 0.1–0.3 mg/kg | Neuromuscular diseases, myasthenia gravis, hepatic impairment, and renal disease | Recovery time may double in patients with cirrhosis or cholestasis | Respiratory: Prolonged, dose-related respiratory insufficiency or apnea | Narcotic (opioid) analgesics: Increases central respiratory depression; monitor respiratory status closely |
| Versed | Sedation, anxiolysis, seizure control, and amnesia | Interacts with GABA receptors, which then exhibit sedative, anxiolytic, amnesic, and hypnotic activities; provides a short-acting CNS depressant action | Adult paralytic: 0.1 mg/kg slow intravenously or intramuscularly<br>Adult RSI: 0.1–0.3 mg/kg slow IVP<br>Adult sedation: 0.5–4 mg IVP or intramuscularly, repeat prn<br>Adult seizure: 2–4 mg intravenously or intramuscularly prn; first choice if no intravenous access<br>Adult burn: 2–5 mg initial dose slow IVP<br>Pediatric RSI: 0.1–0.3 mg/kg intravenous, intramuscular/buccal/sublingual dose 0.15–0.2 mg/kg<br>Pediatric seizure: 0.1–0.3 mg/kg intravenously; dose for intramuscular/buccal/sublingual route is 0.15–0.2 mg/kg;<br>pediatric pain/sedation: 0.1–0.2 mg/kg, max 5 mg | Contraindicated in patients hypersensitive to drug, in those with acute-angle closure glaucoma, and in those experiencing shock, coma, or acute alcohol intoxication; use cautiously in patients with uncompensated acute illnesses, in geriatric or debilitated patients, in patients with myasthenia gravis or neuromuscular disorders and pulmonary disease | Laryngospasm and bronchospasm may occur rarely; countermeasures should be available | CNS: headache, oversedation, drowsiness, amnesia, pain<br>CV: Hypotension, irregular pulse, cardiac arrest | Droperidol, fentanyl, and narcotics can potentiate hypnotic effect of midazolam and increase risk of hypotension |

*Note*. From Epocrated Plus (2018). Thomson Micromedex (2018). CNS = central nervous system; COPD = chronic obstructive pulmonary disease; CSF = cerebrospinal fluid; CV = cardiovascular; CVA = cerebrovascular accident; GABA = g-aminobutyric acid; IVP = intravenous push; MI = myocardial infarction; MOA = mechanism of action; prn = as needed; RSI = rapid sequence intubation.