R. RAPID SEQUENCE INTUBATION – PEDIATRIC
(For children who have not yet reached their 15th birthday)

1. Rapid Sequence Intubation (RSI) Optional Supplemental Program

a) Indications

(1) Inability to tolerate laryngoscopy and have the following:

(a) GCS less than or equal to 8, indicated by a patient that will not: open eyes, cry, say words, or show purposeful movement in response to painful stimulus.

AND

(b) Respiratory insufficiency, demonstrated by oxygen saturation less than or equal to 90% on non-rebreather face mask, respiratory rate less than or equal to 8, or respiratory rate greater than or equal to 45 (age less than 1 yr), greater than or equal to 40 (age 1–5 yrs), greater than or equal to 35 (age 6–9 yrs) with signs of air hunger and accessory muscle use.

ALERT PATIENTS WITH AN IDENTIFIED DIFFICULT AIRWAY WHO CAN BE BAGGED TO AN OXYGEN SATURATION GREATER THAN 90% REQUIRE ON-LINE MEDICAL DIRECTION FOR RSI, PREFERABLY FROM A PEDIATRIC BASE STATION.

(2) On-line medical direction for RSI may be requested (preferably from a Pediatric Base Station), in the following situations:

(a) GCS less than or equal to 8 with clenched jaw, inability to adequately suction airway, and without above respiratory parameters

(b) Respiratory extremis with contraindications to nasotracheal intubation (respiratory rate greater than or equal to 35 with air hunger, use of accessory muscles, and oxygen saturation less than or equal to 90% on non-rebreather face mask)

(c) Identified difficult airway patient with a GCS less than or equal to 8 and signs of respiratory insufficiency who cannot tolerate laryngoscopy but is able to be bagged to an oxygen saturation greater than 90%

b) Contraindications

(1) Conditions that may cause hyperkalemia:

(a) Burns greater than 24 hours old

(b) Spinal cord injury greater than 24 hours old

(c) Known neuromuscular disease (Guillain-Barré Syndrome, myasthenia gravis, amyotrophic lateral sclerosis, muscular dystrophy)

(d) Chronic renal failure on hemodialysis/presence of hemodialysis access

(2) History of malignant hyperthermia

c) Preparation

(1) Pre-oxygenate with 90–100% oxygen.
(2) Monitor oxygen saturation with pulse oximetry and EKG.
(3) Ensure functioning IV and fluid therapy as per protocol.
(4) Evaluate for difficult airway.
(5) Perform focused RSI neurologic exam.
(6) Prepare equipment
  (a) Intubation kit: Recommended to carry both cuffed and uncuffed ET tubes for patients less than 8 years of age or 25 kg.
  (b) Bag-Valve-Mask (BVM) with manometer. (Manometer may be part of the BVM or separate.)
  (c) Suction
  (d) RSI kit
    (i) Prepare medications
    (ii) Alternative airway device, Cricothyroidotomy equipment
  (e) Capnograph

d) RSI Procedure

(1) Adequate sedation must be provided to prevent awareness during paralysis from neuromuscular blockade.

Etomidate, if available, will be the preferred agent for patients who are aware of their surroundings and do not have hypotension or possible hypovolemia.

Dose: Administer 0.3 mg/kg IVP over 30–60 seconds. If the patient is hypotensive or the provider suspects hypovolemia, the initial dose will be 0.15 mg/kg IVP over 30–60 seconds. May repeat 0.15 mg/kg IVP in 2–3 minutes if inadequate sedation.

Ketamine may be used if etomidate is unavailable, and may be preferred for patients who have hypotension or possible hypovolemia.

Dose: Administer 2 mg/kg IVP over 60 seconds.

Midazolam should be considered for patients with isolated head injury and elevated blood pressure, especially with possible seizure activity. Midazolam should not be used for patients with hypotension, and should be avoided with possible hypovolemia.

Dose: Administer 0.05 mg/kg IVP over 1–2 minutes. Maximum single dose is 5 mg.

(a) **Hold for** BP less than 60 in neonates (patients less than 28 days old), less than 70 in infants (patients less than 1 year of age), less than [70 + (2 x years) = systolic BP] for patients greater than 1 year of age.

(2) For patients with head injury or suspected increased intracranial pressure, administer lidocaine 1 mg/kg IVP over 1–2 minutes.
(3) If patient is less than 8 years of (or if age unknown and using ET tube smaller than 6.0), pretreat patient with atropine 0.02 mg/kg IVP.

(4) In-line cervical spine stabilization by second caregiver (in trauma setting)
(5) Apply cricoid pressure (by third caregiver).
(6) Succinylcholine: Administer 1.5 mg/kg rapid IVP.
(7) Intubate trachea and verify ET placement.
(8) If inadequate relaxation after 2–3 minutes, repeat succinylcholine 1.0 mg/kg IVP.

e) Successful Endotracheal Tube Placement

(1) Release cricoid pressure and secure ET.
(2) Ventilate to $ETCO_2$ of 30–32 mmHg.
(3) If significant resistance to ventilation occurs as succinylcholine wears off (4–5 minutes), refer to Ventilatory Difficulty Secondary to Bucking Protocol.

f) Unsuccessful Endotracheal Tube Placement

(1) Maintain cricoid pressure and resume BVM ventilation for 30 seconds.
(2) If unable to ventilate, see "If Unable to Ventilate" below.
(3) Reattempt oral ET intubation.
(4) If unsuccessful, resume BVM ventilation for 30 seconds.
(5) Insert a laryngeal mask airway designed to facilitate hospital placement of an endotracheal tube (see Airway Management: Laryngeal Mask Airway Optional Supplemental Program).

g) If Unable to Ventilate

If unable to ventilate, verify appropriate oropharyngeal airway placement and reposition BVM for optimal mask seal. If still unable to ventilate, refer to Needle Cricothyroidotomy Protocol.

2. Ventilatory Difficulty Secondary to Bucking or Combativeness in Intubated Patients

a) Indication

Patients successfully intubated with an endotracheal tube, or needle cricothyroidotomy, for whom the ability to provide manual or mechanical ventilation is impaired secondary to bucking or combativeness

b) Contraindication

Unsecured airway

c) Procedure

(1) **Etomidate**, if available, will be the preferred agent for patients who are aware of their surroundings and do not have hypotension or possible hypovolemia.

Dose: Administer 0.3 mg/kg IVP over 30–60 seconds. If the patient is hypotensive or the provider suspects hypovolemia, the initial dose will be 0.15 mg/kg IVP over 30–60 seconds. May repeat 0.15 mg/kg IVP in 2–3 minutes if inadequate sedation.

OR

Ketamine may be used if etomidate is unavailable, and may be preferred for patients who have hypotension or possible hypovolemia, or if ventilatory difficulty is thought to be the result of pain response.

Dose: Ketamine: 2 mg/kg IVP over 60 seconds. May repeat 1 mg/kg for IVP every 10–15 minutes to a total of three doses as necessary.

Additional doses require medical consultation.

OR

Midazolam should be considered for patients with isolated head injury and elevated blood pressure, especially with possible seizure activity. Midazolam should not be used for patients with hypotension, and should be avoided with possible hypovolemia.

Dose: Administer 0.05 mg/kg IVP over 1–2 minutes, titrated to abate bucking and relax ventilation while maintaining systolic BP: greater than 60 in neonates, 70 in infants, [70 + (2 x years) = systolic BP] for patients greater than 1 year of age. Maximum single dose is 5 mg.

(2) If ventilatory difficulty is thought to be the result of pain response,
Ketamine: Dose: 2 mg/kg IVP over 60 seconds. May repeat 1 mg/kg IVP every 10–15 minutes as necessary to a total of three doses as necessary.

Additional doses require medical consultation.

OR

Opioid may be used per Pain Management Protocol in addition to, or instead of, midazolam, ketamine, or etomidate. Titrate to abate bucking and relax ventilation while maintaining systolic BP greater than 60 in neonates, 70 in infants, [70 + (2 x years) = systolic BP] for patients greater than 1 year of age.

(3) If significant resistance to ventilation continues, the paramedic may administer:

(a) Vecuronium 0.05 mg/kg IVP (may not be used for patients with needle cricothyroidotomy because of inability to monitor breath to breath $ETCO_2$). Maximum single dose is 10 mg.

ALERT

PRE-SEDATION MUST BE PROVIDED WHEN VECURONIUM IS ADMINISTERED TO A PATIENT WHO IS EITHER RESPONSIVE TO STIMULUS OR MAY BECOME RESPONSIVE TO STIMULUS DURING NEUROMUSCULAR BLOCKADE. VECURONIUM MAY ONLY BE USED IF CONTINUOUS, BREATH TO BREATH $ETCO_2$ MONITORING CAN BE PROVIDED.

(b) Dose may be repeated in 2-3 minutes if necessary.

(c) **Maintenance of Amnesia**
Follow above dosing of either **etomidate** or **ketamine** with required repeat dosing every 10–15 minutes.

(4) Continue to monitor oxygen saturation and ventilate to desired $ETCO_2$.
(5) Obtain on-line medical direction (preferably from a Pediatric Base Station), if further problems present.

3. Protocol for Cricothyroidotomy
Surgical (for 8 years old or greater) and Needle

a) Indications
(1) Inability to ventilate despite having tried BVM with oropharyngeal/ nasopharyngeal airway, ET placement, and alternative airway device (if not contraindicated)
(2) Inability to place ET in the setting of life-threatening upper airway hemorrhage
(3) Completely obstructing upper airway foreign body that cannot be removed via BLS maneuvers or Magill forceps with direct visualization

b) Preparation
(1) Prepare suction and cricothyroidotomy kit.
(2) Begin at sternal notch and locate cricoid cartilage.
(3) Palpate cricothyroid membrane anteriorly between cricoid cartilage and thyroid cartilage.
(4) Prepare skin with betadine or alcohol swabs.

c) Surgical Cricothyroidotomy <u>for 8 years old or greater</u>
(1) Stabilize thyroid cartilage and make vertical incision (1–1 1/2 inches) over cricothyroid membrane. Alternatively, a needle puncture dilator device may be utilized.
(2) Palpate cricothyroid membrane with gloved finger and carefully make transverse incision through membrane. Insert scalpel handle and rotate 90 degrees.
(3) Insert a 5 to 6.0 mm cuffed ET tube, using the natural curve of tube.
(4) Insert ET tube to just beyond cuff.
(5) Inflate cuff and ventilate patient.
(6) Monitor oxygen saturation and $ETCO_2$ carbon dioxide level.
(7) Secure ET tube. (Do not cut or trim ET tube.)
(8) If significant resistance to ventilation develops, or if patient develops difficulty in tolerating successful cricothyroidotomy, refer to Ventilatory Difficulty Secondary to Bucking or Combativeness Protocol.

ALERT ONLY NEEDLE CRICOTHYROIDOTOMY SHOULD BE PERFORMED FOR PATIENTS LESS THAN AGE 8 WHO MAY REQUIRE CRICOTHYROIDOTOMY.

d) Needle Cricothyroidotomy

(1) Insert 12- or 14-gauge over-the-needle catheter through the cricothyroid membrane at a 45-degree angle toward the feet. Aspiration of air with a syringe indicates tracheal entry.

(2) Hold needle in place and advance catheter, then remove needle.
(3) Attach catheter hub to intermittent jet oxygen insufflator valve.
(4) Manually secure catheter at hub at all times to prevent kinking or displacement.
(5) Monitor oxygen saturation.
(6) If significant resistance to ventilation develops, or if patient develops difficulty in tolerating cricothyroidotomy, refer to Ventilatory Difficulty Secondary to Bucking or Combativeness Protocol.

4. Pediatric RSI Quality Assurance Process

a) Individual Paramedic Approval for Pediatric RSI Pilot Participation

(1) Successful completion of small group training includes all of the following:
  (a) Classroom lecture
  (b) Mannequin instruction
  (c) Must demonstrate proficiency through skills testing and written test
(2) Successful completion of individualized operating room training
  (a) Individual operating room training with Pediatric/Critical Care/ Anesthesiology Attending approved by the Associate State EMS Medical Director for Pediatrics
  (b) Must demonstrate proficiency to Attending Pediatric/Critical Care/ Anesthesiologist's satisfaction

b) Ongoing Demonstration of Proficiency

(1) A verification of all pediatric and adult RSI skills and review of pediatric and adult RSI principles of safety will be performed on a quarterly basis.
(2) Documentation of the quarterly verification process shall be submitted to the State EMS Medical Director on an annual basis.

c) Review of Each Call

(1) Mechanism for follow-up of each call will be in accordance with the Quality Review Procedure for Pilot Programs (formerly "Class B" Additional Procedure Algorithm) of the Maryland Medical Protocols, with the following additions:
  (a) Immediate notification to jurisdictional RSI supervisor for all RSI attempts
  (b) Medical Director evaluation of all RSI attempts within 12 hours
  (c) Maintenance of detailed RSI database
  (d) All individual RSI attempts shall be documented after the jurisdictional review process on the approved RSI QA form and submitted to the State EMS Medical Director on a quarterly basis.