

**APPENDIX: 02****TITLE: Advanced Airway Support Supplement****REVISED: November 1, 2023****I. BACKGROUND:**

The purpose of this supplement is to provide a holistic approach to advanced airway management. Known as broadly as Rapid Sequence Induction (RSI), Delayed Sequence Intubation (DSI)\*, Crash Airway Procedures (CAP), Medicated Assisted Intubation (MAI), etc., Advanced airway management is complex, requiring dynamic clinical judgement and teamwork from all providers on scene to achieve the best outcome possible.

\* “Delayed Sequence Intubation” is the specific strategy where the intubation (or other advanced airway) is delayed/slowed until aggressive preoxygenation and hemodynamic resuscitation occurs in patients whom emergency airway management would be otherwise unsafe due to the risk of decompensation, hypoxemia, and hypotension.

**II. INDICATIONS**

Indication for advanced airway management include:

- Failure to oxygenate
- Failure to Ventilate
- Failure to maintain the airway
- And based on anticipated clinical course (anticipated failure of any of the above)

Specific examples of circumstances (not all inclusive) which may necessitate pharmacological agent use during airway management:

- Isolated head trauma
- Cerebrovascular accidents
- Multiple system trauma
- Overdose
- Status epilepticus
- Acute pulmonary edema
- Respiratory failure
- Severe burns (with suspected airway/respiratory involvement)

The above indications are applicable in instances that it becomes necessary to manage severe respiratory distress, optimize airway protection, hyperventilate for central nervous system lesions, or to provide ventilatory assistance in the presence of hypoventilation and hypoxia when other means of doing so are ineffective or contraindicated.

### III. MEDICATIONS

MEDICATIONS (not all inclusive): The use of medications to assist in intubation is both lifesaving and risky. Pharmacological agents should be used to assist the paramedic in performing advanced airway management in patients who are difficult to manage due to excessive gag reflex, combativeness, or other factors; and in instances where protecting the airway is a potentially life-saving maneuver.

The choice of medications (to include timing and doses) should be selected with the patient's clinical situation in mind with the goal of minimizing or avoiding adverse effects (such as hypotension) and outcomes (such as peri-airway arrest). *The paramedic should be thoroughly familiar with ALL DRUGS DISCUSSED WITHIN THIS SECTION.*

- a. **Sedative Hypnotics.** To be used before paralyzing agents as an induction agent *alternative* to ketamine.
  - *Etomidate (Amidate):* for adults and children greater than two years of age
    - i. ADULTS and PEDS IV/IO: 0.2 – 0.4 mg/kg
- b. **Dissociative Anesthetic.** To be used before paralyzing agents as an induction agent *alternative* to etomidate. Also, may be used for post-airway analgesia if contraindications exist to standard post airway management (i.e. opioids and benzodiazepines).
  - *Ketamine:* Ketamine is an ideal induction agent as has the least effect on airway reflexes and respiratory drive. IV/IO onset is rapid (30-60 seconds)
    - i. ADULTS and PEDS IV/IO: 1-2 mg/kg SLOW IV push over at least one minute (ideally two to three minutes) prior to paralytic administration. Repeat at 0.5-1 mg/kg as needed to achieve / maintain disassociation.
  - Rapid administration should be avoided as this may cause laryngospasm and apnea.
- c. **Neuromuscular Blocking Agents:** Paralytics should never be used without adequate sedation/analgesia.
  - *Succinylcholine chloride (Anectine):*
    - i. Pre-Airway: To be used after etomidate or ketamine
    - ii. Post-Airway: Should not be used to post-airway paralysis except as a last resort.
    - iii. ADULTS (IV/IO): 1-2 mg/kg, repeat one time only
    - iv. PEDS (IV/IO): 1-2 mg/kg for children, 2 mg/kg for infants

- *Rocuronium bromide (Zemuron):*
  - i. Pre-Airway: To be used as an alternative to succinylcholine when clinically indicated.
  - ii. Post-Airway: long-acting paralytics are to be used only after the airway is secured and confirmed.
  - iii. ADULTS and PEDS (IV/IO): 1mg/kg, repeat PRN
- *Vecuronium (Norcuron):*
  - i. Pre-Airway: To only be used as an alternative to rocuronium or succinylcholine when clinically indicated.
  - ii. Post-Airway: long-acting paralytics are to be used only after the airway is secured and confirmed.
  - iii. ADULTS and PEDS IV/IO: 1mg/kg, repeat PRN
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- d. **Benzodiazepines (BZD).**
  - a. *Midazolam (Versed)*
    - i. Versed is the preferred benzodiazepine in the post-intubation setting:
    - ii. ADULTS IV/IO/IM: 0.5-5 mg, max total dose 10mg
    - iii. PEDS IV/IO: 0.1-0.2 mg/kg, max single dose 5 mg, max total dose 10 mg
  - b. *Diazepam (Valium):*
    - i. ADULTS IV/IO/IM: 5-10 mg, repeat PRN, max total dose 20 mg
    - ii. PEDS IV/IO: 0.2-0.3 mg/kg, repeat PRN, max total dose 20 mg
  - c. *Lorazepam*
    - i. ADULTS and PEDS (IV/IO): 0.05 mg/kg, titrate to sedation, repeat at 10 minutes PRN, max single dose 2 mg, max total dose 4 mg
- e. **Opiates.** Cautionary use with hypotension:
  - a. *Morphine Sulfate (MS)*
    - i. ADULTS (IV/IO/IM): 0.1 mg/kg initial dose, repeat at 0.05mg/kg every 10 min PRN, max single dose 10 mg, max total dose 20 mg
    - ii. PEDS (IV/IM/IO): 0.1 mg/kg, repeat at 0.05 mg/kg every 10 min PRN, max single dose 5 mg, max total dose 15 mg
  - b. *Fentanyl, (Sublimaze)*
    - i. ADULTS (IV/IO/IM): 1 mcg/kg initial dose, repeat every 10 min PRN, max single dose 100 mcg, max total dose 200 mcg
    - ii. PEDS (IV/IO): 1 mcg/kg, repeat every 10 min PRN, max single dose 75 mcg, max total dose 150 mcg
- f. **Other Medications.** Used in specific situations:
  - a. *“Push Dose” Epinephrine* 1:100,000 to treat peri-airway management hypotension, and as a bridge to vasopressor infusions in peri-airway management.
    - i. To Mix: 1 ml (0.1 mg) of 1:10,000 Epinephrine (“Cardiac Arrest Epi”) in a 9 ml NaCL Flush for a 10 mcg/cc concentration. **LABEL SYRINGE.**
    - ii. IV/IO: initial dose of 20 mcg (2 ml) followed by 5 mcg (0.5 ml) repeated 2-3 minute as needed for hypotension and/or bridge to infusion (if appropriate).

## IV. PROCEDURE:

## a. Plan

- a. Treat every airway as a potentially difficult airway
- b. Have a plan A, B, and C (See Section IV)
- c. Make sure the team “knows the plan”
- d. Anticipate Problems: These conditions (AKA *HEAVEN* criteria) have been shown to significantly increase the likelihood of difficult airway.
  - i. Hypoxemia,
  - ii. Extremes of size,
  - iii. Anatomic abnormalities,
  - iv. Vomit/blood/fluid,
  - v. Exsanguination
  - vi. Neck mobility issues

## b. Preparation

- a. Ensure adequate oxygenation while preparation occurs
- b. Have the following ready:
- c. Bag-valve-mask connected to functioning oxygen delivery system
- d. Working suction with tubing and suction tip attached
- e. Full Intubation set to include:
  - i. Endotracheal tube(s) with stylet, syringe and intact cuff and ETT
  - ii. Laryngoscope with blades and bright light source.
  - iii. Scalpel (full cricothyrotomy kit preferred)
  - iv. Alternative airway (i.e., SGA, LMA if available and appropriate)
  - v. Endotracheal tube introducer (AKA the “bougie”, Flexiguide)
  - vi. Anticipated pharmacological agents
  - vii. Manpower to adequately manage the patient in the event of desaturation or other adverse event (i.e. Cardiac Arrest) .
  - viii. Check to be sure that a functioning, secure vascular access device (IV or IO) is in place.
    - Note: If unable to establish IV or IO access certain drugs may be given IM instead
  - ix. Cardiac monitor, ETCO<sub>2</sub>, and SPO<sub>2</sub>. Be alert for the possibility of bradycardia or other dysrhythmias. Bradycardia and desaturation can be peri-arrest indicators.
- f. Alternative Airway (i.e., SGA, LMA if available and appropriate)
- g. Cricothyrotomy kit
- h. Assess the patient for likelihood of successful intubation and need for definitive airway, and the feasibility of alternative methods (Nasal ETT, SGA, LMA, BVM use only).
- i. Ensure adequate oxygenation, with a BVM or CPAP if required, while preparing the equipment.

**c. Positioning**

- a. Ideally, position the patient *'head up'* at 30 degrees (or more), with auditory meatus above the jugular notch. This is optimal intubation position and reduces vomiting. This may not be possible in all situations.
- b. Position and manipulate airway to facilitate opening the airway.

**d. Pre-Oxygenate:** Choose preoxygenation device based on the patient's SpO<sub>2</sub> and clinical presentation. Oxygenation should ideally occur for 2-3 minutes prior to advanced airway attempts unless patient's situation precludes this (inability to ventilate with BVM and inability to protect airway).

- a. Oxygenation should target an SPO<sub>2</sub> of  $\geq 94\%$ . This ensures sustained oxygenation during the intubation attempt ("Safe Apnea").
- b. Place standard nasal cannula at "high flow" rates at prior to placement of the preoxygenation device. Examples include:
  - i. A Nasal Cannula at high flow rates (6+ LPM for PEDS, 15+ LPM for ADULTS)
  - ii. AND/OR bag-valve-mask (BVM) with PEEP valve and a good seal at 15 L/min O<sub>2</sub>,
  - iii. AND/OR non-rebreather (NRB) mask and a good seal at 15 L/min O<sub>2</sub> (or more)
  - iv. AND/OR CPAP with 100% FiO<sub>2</sub>.

**e. Resuscitate**

- a. Address Hypotension/physiology if possible, depending on clinical presentation.

**f. Procedural Pause**

- a. Pause and brief team regarding "Primary Plan", Roles, and "Contingency Plans"

**g. Medications**

Administer induction agent(s) and pre-airway paralytic 45-60 seconds prior to Advanced Airway Procedure:

- a. Administer Induction agent (Ketamine or Etomidate)
- b. Neuromuscular Blocking Agents (Succinylcholine, Rocuronium bromide or Vecuronium)
  - i. If conducting a DSI approach, consider the use of Rocuronium instead of Succinylcholine)

As patient relaxes:

- c. (DSI) If patient clinical condition permits, another "procedural pause" is appropriate between induction/sedation and administration of paralytics to evaluate the patient's hemodynamic status.

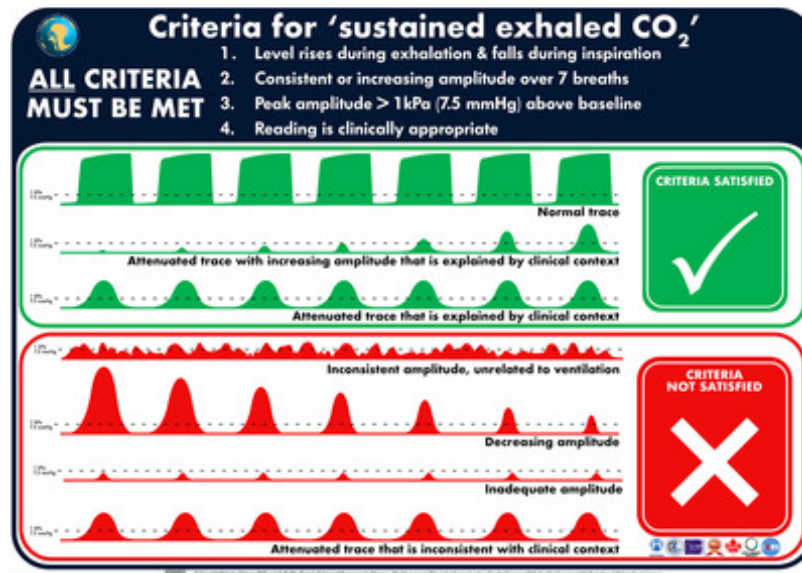
- d. Consider applying laryngeal manipulation/"B.U.R.P." until intubation is successfully completed, the endotracheal tube cuff is inflated, and tube position confirmed
- e. After fasciculation's stop (if they occur), demonstrate adequate jaw relaxation by manipulating the mandible. Jaw relaxation and decreased resistance to bag-mask ventilations indicate that the cords are paralyzed and that it is time to proceed with intubation.
- f. If inadequate relaxation is present, give either a:
  - i. Second dose of Induction Agent
    1. OR
  - ii. Initial or second dose of Neuromuscular Blocking Agent

#### **h. Advanced Airway Placement**

- a. Refer to SWO Appendix 3: "Intubation Procedures"
- b. Refer to SWO Appendix 4: "SUPRAGLOTTIC AIRWAY PROCEDURES"
- c. Refer to SWO Appendix 5: "CRICOTHYROTOMY (SURGICAL/NEEDLE/Quick Trach)"

#### **i. Post Airway Confirmation, Monitoring and Maintenance**

- a. Post airway monitoring should include
  - i. **Waveform ETCO<sub>2</sub>**: As esophageal intubation is not necessarily always associated with a completely flat or absent ETCO<sub>2</sub>, the standard of a "sustained" ETCO<sub>2</sub> immediately after placement of the advanced airway and throughout patient care until transfer of care is required.
    - "Sustained" ETCO<sub>2</sub> is defined as a minimum of 7 consecutive breaths. The ETCO<sub>2</sub> is consistent or increasing amplitude of the capnogram over 7 breaths.
    - The level of CO<sub>2</sub> rises and falls appropriately with exhalation and inhalation.
    - The peak amplitude/change of CO<sub>2</sub> is a minimum of 7.5 mm Hg above the baseline.
    - The capnogram is clinically appropriate for the patient.



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ii. Colormetric ETCO<sub>2</sub>:

- Colorimetric ETCO<sub>2</sub> (i.e., EZCAP) is inherently inferior to waveform capnography and is intended only as a bridge or backup if waveform ETCO<sub>2</sub> is delayed.
- Colormetric ETCO<sub>2</sub> are usually only accurate for *initial* 2-4 breaths, and therefore not suitable to confirm “sustained” ETCO<sub>2</sub> or for continuous ETCO<sub>2</sub> monitoring.
- Adult colormetric ETCO<sub>2</sub> may not be suitable for small children or infants.

iii. Frequent D.O.P.E.S. assessments

- **D:** Displacement
- **O:** Occlusion
- **P:** Pneumothorax
- **E:** Equipment failure/functioning optimally
- **S:** Stacked breaths (Increased intrathoracic pressure, hemodynamic compromise, and Barotrauma)

iv. Airway monitoring should be continuous, with additional checks (i.e., for sustained ETCO<sub>2</sub>, auscultation, depth checks, etc.) frequently, but particularly with:

- Patient movement
- Transfer of care
- Deterioration

**b. Post Airway Medications**

- a. **Non-Depolarizing Neuromuscular Blocking Agents.** These are long-acting paralytics to be used only after the ETT is secured:
- b. **Benzodiazepines (BZD).** Versed is the preferred benzodiazepine in the post-intubation setting. Cautionary use with hypotension.
- c. **Opiates.** Excellent for post intubation analgesia. Cautionary use with hypotension.
- b. **Dissociative Anesthetic:** Ketamine may be used for post-airway analgesia if contraindications exist to standard post airway management (i.e., opioids and benzodiazepines).

- V. **Difficult Airway Procedure:** If the Provider/team experiences difficult airway placement (defined as a single unsuccessful, difficult, or prolonged attempt, or anticipated Difficulty) then this is the standardized approach to difficult airway management. In all cases, clinical judgement remains paramount.



# Difficult Airway

## **Plan A:** Direct Laryngoscopy

Abort attempt if SPO<sub>2</sub> falls below predetermined threshold  
Reoxygenate w/ 2 person BVM/OPA/NPA between attempts  
**Maximum 3 attempts**

Consider  
Alternate provider  
Alternate position  
Alternate blade  
Laryngeal manipulation

## **Plan B:** Supraglottic Airway

Airway Burns: direct to cricothyrotomy  
Place SGA  
Secure device, monitor w/ EtCO<sub>2</sub>  
Consider post intubation medication

## **Plan C:** Maintain Oxygenation

2 person BVM/OPA/NPA  
Allow return of ventilatory effort

## **Plan D:** Cricothyrotomy

Can't maintain oxygenation  
Can't intubate/Can't ventilate  
**Perform Emergent Cricothyrotomy**  
Do not delay! Commit!  
Secure device, monitor w/ EtCO<sub>2</sub>  
Consider post intubation medication

Modified from DAS Guidelines for Management of Difficult Intubation. See [das.uk.com](http://das.uk.com)

**Every Airway, Every Time**

**ADVANCED AIRWAY SUPPORT**

**PHYSICIAN PEARLS:**

Previously, lidocaine and Atropine was used for pretreatment in certain patients (head injury and pediatrics respectfully). A review of the evidence has shown no clear benefit to this practice but increased risk of complications. Therefore, the use of lidocaine or Atropine routinely during advanced airway procedures for increased ICP or pediatrics is no longer recommended.

Use of induction agents without following with neuromuscular blockade may result in significantly suboptimal intubation conditions in patients who are not in deep coma states or cardiac arrest. Induction only intubation should be considered Clinical Judgement is paramount.

Use of medications in advanced airway management should only be used with the intent to place an advanced airway, not to “take a look”.