Joint Trauma System

# Airway Trauma Injury Management

Part of the Joint Trauma System (JTS) Clinical Practice Guideline (CPG) Training Series

# Agenda

- Purpose
- Summary
- Background
- Airway Trauma Management
- Performance Improvement (PI) Monitoring
- References
- Appendices

# Purpose

This goal is to optimize the airway management for patients with traumatic injury in the operational medical treatment facility environment.

*This presentation is based on the JTS Airway Management of Traumatic Injuries CPG, 17 Jul 2017 (ID:39). It is a high-level review. Please refer to the complete CPG for detailed instructions. Information contained in this presentation is only a guideline and not a substitute for clinical judgment.*

# Summary

- High risk of requiring intubation, be prepared for a difficult airway.
- Practice and prepare for alternatives other than rapid sequence intubation.

# Background

- Airway obstruction was the second most common cause of potentially survivable death in all US combat casualties from Oct 2001 to Jun 2011.
  - Airway management is a critical step in the resuscitation of the trauma patient.
  - All trauma airways are potentially high-risk; anticipate a difficult airway.

# Background

All injured patients who present with obtundation (GCS<8), apnea, respiratory distress or insufficiency, airway obstruction, or impending airway loss will have a secure and definitive airway established expeditiously upon arrival to a theater Military Treatment Facility (MTF).

# Airway Trauma Management

- Standard Rapid Sequence Induction (RSI) and Intubation Pathway
  - ❑ Confirm Equipment Availability and Function: IV, suction, self-inflating bag and mask, oxygen source, laryngoscope, Endotracheal tube with stylet and/or bougie, oral and nasal airways, surgical airway kit, drugs, monitors, other rescue equipment
  - ❑ Pre-Oxygenate the lungs: Prolongs tolerance of apneic period with goal of approximately 3 minutes at 90% FiO2
  - ❑ Maintain cervical spine stabilization.
  - ❑ Remove front of cervical collar.
  - ❑ Consider cricoid pressure simultaneous with medication administration.
  - ❑ Administer medications: Sedative/hypnotic (ketamine first line) and neuromuscular blockade

# Airway Trauma Management

- RSI and Intubation Pathway (continued)
  - ❑ Perform laryngoscopic tracheal intubation.
    - If view is poor, apply external manipulation techniques.
    - Consider alternative visualization or supraglottic airway device.
  - ❑ Confirm tracheal intubation.
    - Visualize passing through vocal cords (first line).
    - Wave form or digital capnography (second line).

# Airway Trauma Management

Defense Health Agency

Highly algorithmic process with multiple options beyond the standard pathway which requires review and practice by practitioners along with team members

**Airway Management**

- All trauma airways are potentially high-risk. Anticipate a difficult airway.
- Identify critical team members and verbalize role assignments.
- Initiate pre-oxygenation.
- Consider Ketamine (0.5-1.0 mg/kg IV/IO) for delayed sequence intubation if combative or otherwise uncooperative patient.
- Recall that the neutral position ("C-spine stabilization") degrades the laryngoscopic view.

**Rapid Sequence Induction (RSI) and Intubation Pathway**

1. Confirm equipment availability and function IV/IO, suction, self-inflating bag and mask, oxygen source, laryngoscope- direct and video, ETT with stylet and/or gum elastic bougie, oral & nasal airways, surgical airway kit, drugs, C02 detector, monitors, other rescue equipment
2. Pre-Oxygenate (Denitrogenate) the lungs
   - Prolongs tolerance of apneic period
   - Goal is = 3 minutes of tidal volume breathing at 90% FiO2
   - With standard reservoir facemask set flow rate of oxygen as high as possible
   - Recommend augmenting with nasal cannula at 15L/min oxygen in preparation for apneic oxygenation, leave in situ throughout procedure
   - Elevate head of bed if not contraindicated
3. Maintain cervical spine stabilization
4. Remove front of cervical collar
5. Consider cricoid pressure simultaneous w/ medication administration (9,10)
6. Administer medications : Initiate RSI

| ***Sedative/hypnotic*** | ***Neuromuscular Blockade*** |
|---|---|
| ▪ Ketamine (First Line): 2 mg/kg IV/IO<br>▪ Etomidate (Second Line): 0.3 mg/kg IV/IO<br>▪ Unstable patients require reduced dosage of induction agent. | ▪ Rocuronium: 1.2 mg/kg IV/IO or<br>▪ Vecuronium: 0.1 mg/kg IV/IO or<br>▪ Succinylcholine: 1.5 mg/kg IV/IO |

7. Perform laryngoscopic tracheal intubation
   - Following onset of neuromuscular blockade
   - Recommend gum elastic bougie as primary ETT stylet
8. If laryngoscopic view is poor:
   - Apply external laryngeal manipulation technique(s)
   - Consider alternative visualization method or Supraglottic airway device
9. Confirm tracheal intubation
   - Visualize tube passing between the vocal cords (First Line)
   - Wave form or digital capnography when available (Second Line)
   - Easy chest rise, equal axillary breath sounds/absence of gastric insufflation, CO2 Calorimeter, and "fog" in ETT
   - Esophageal detector bulb or fiber optic confirmation during cardiac arrest
10. Provide continuing care IAW Anesthesia CPG

**Recommendations for Pediatric Patients**

1. Train to expect pediatric patients. Have a dedicated pediatric airway cart, including Broselow tape or equivalent.
2. Pre-dose with atropine IV/IO (0.02mg/kg, minimum dose 0.1mg, maximum dose 0.5mg) in all <1 years old, those <5 who are receiving succinylcholine, and in all who receive a 2nd dose of succinylcholine
3. Induction
   - Ketamine (first line) 2mg/kg IV/IO
   - Etomidate (second line) 0.3mg/kg IV/IO
4. Neuromuscular blockade -
   - Succinylcholine 1.5mg/kg IV/IO (2mg/kg <5 years old) or Rocuronium 1mg/kg IV/IO
   - Avoid surgical airway in <12 years old - use needle cricothyroidotomy (12-14 gauge), tracheostomy preferred over surgical cricothyroidotomy

**Unable to Intubate: Can you Mask Ventilate?**

**Mask Ventilation Pearls**
- Skilled operator
- Good seal
- Jaw thrust
- Oral airway
- Nasal airway(s)
- Two operator mask ventilation

| | |
|---|---|
| **YES** | ▪ Improve position, change blade/operator, laryngeal manipulation technique, gum elastic bougie.<br>▪ Attempt alternate technique: Fiber optic, video laryngoscope, tracheal trans illumination device.<br>▪ More than = 3 attempts at intubation may abolish your ability to mask ventilate due to edema caused by laryngoscopy.<br>▪ Surgical airway (Cricothyroidotomy or tracheostomy) |
| **NO** | ▪ Emergency pathway…seconds matter.<br>▪ Supraglottic airway or<br>▪ Surgical cricothyroidotomy |

## Airway Management

- All trauma airways are potentially high-risk. Anticipate a difficult airway.
- Identify critical team members and verbalize role assignments.
- Initiate pre-oxygenation.
- Consider Ketamine (0.5-1.0 mg/kg IV/IO) for delayed sequence intubation if combative or otherwise uncooperative patient.
- Recall that the neutral position ("C-spine stabilization") degrades the laryngoscopic view.

## Rapid Sequence Induction (RSI) and Intubation Pathway

1. Confirm equipment availability and function IV/IO, suction, self-inflating bag and mask, oxygen source, laryngoscope- direct and video, ETT with stylet and/or gum elastic bougie, oral & nasal airways, surgical airway kit, drugs, C02 detector, monitors, other rescue equipment
2. Pre-Oxygenate (Denitrogenate) the lungs
   - Prolongs tolerance of apneic period
   - Goal is ≈ 3 minutes of tidal volume breathing at 90% FiO2
   - With standard reservoir facemask set flow rate of oxygen as high as possible
   - Recommend augmenting with nasal cannula at 15L/min oxygen in preparation for apneic oxygenation, leave in situ throughout procedure
   - Elevate head of bed if not contraindicated
3. Maintain cervical spine stabilization
4. Remove front of cervical collar
5. Consider cricoid pressure simultaneous w/ medication administration (9,10)
6. Administer medications : Initiate RSI

***Sedative/hypnotic***
- Ketamine (First Line): 2 mg/kg IV/IO
- Etomidate (Second Line): 0.3 mg/kg IV/IO
- Unstable patients require reduced dosage of induction agent.

***Neuromuscular Blockade***
- Rocuronium: 1.2 mg/kg IV/IO or
- Vecuronium: 0.1 mg/kg IV/IO or
- Succinylcholine: 1.5 mg/kg IV/IO

7. Perform laryngoscopic tracheal intubation
   - Following onset of neuromuscular blockade
   - Recommend gum elastic bougie as primary ETT stylet
8. If laryngoscopic view is poor:
   - Apply external laryngeal manipulation technique(s)
   - Consider alternative visualization method or Supraglottic airway device
9. Confirm tracheal intubation
   - Visualize tube passing between the vocal cords (First Line)
   - Wave form or digital capnography when available (Second Line)
   - Easy chest rise, equal axillary breath sounds/absence of gastric insufflation, CO2 Calorimeter, and "fog" in ETT
   - Esophageal detector bulb or fiber optic confirmation during cardiac arrest
10. Provide continuing care IAW Anesthesia CPG

## Recommendations for Pediatric Patients

1. Train to expect pediatric patients. Have a dedicated pediatric airway cart, including Broselow tape or equivalent.
2. Pre-dose with atropine IV/IO (0.02mg/kg, minimum dose 0.1mg, maximum dose 0.5mg) in all <1 years old, those <5 who are receiving succinylcholine, and in all who receive a 2nd dose of succinylcholine
3. Induction
   - Ketamine (first line) 2mg/kg IV/IO
   - Etomidate (second line) 0.3mg/kg IV/IO
4. Neuromuscular blockade -
   - Succinylcholine 1.5mg/kg IV/IO (2mg/kg <5 years old) or Rocuronium 1mg/kg IV/IO
   - Avoid surgical airway in <12 years old - use needle cricothyroidotomy (12-14 gauge), tracheostomy preferred over surgical cricothyroidotomy

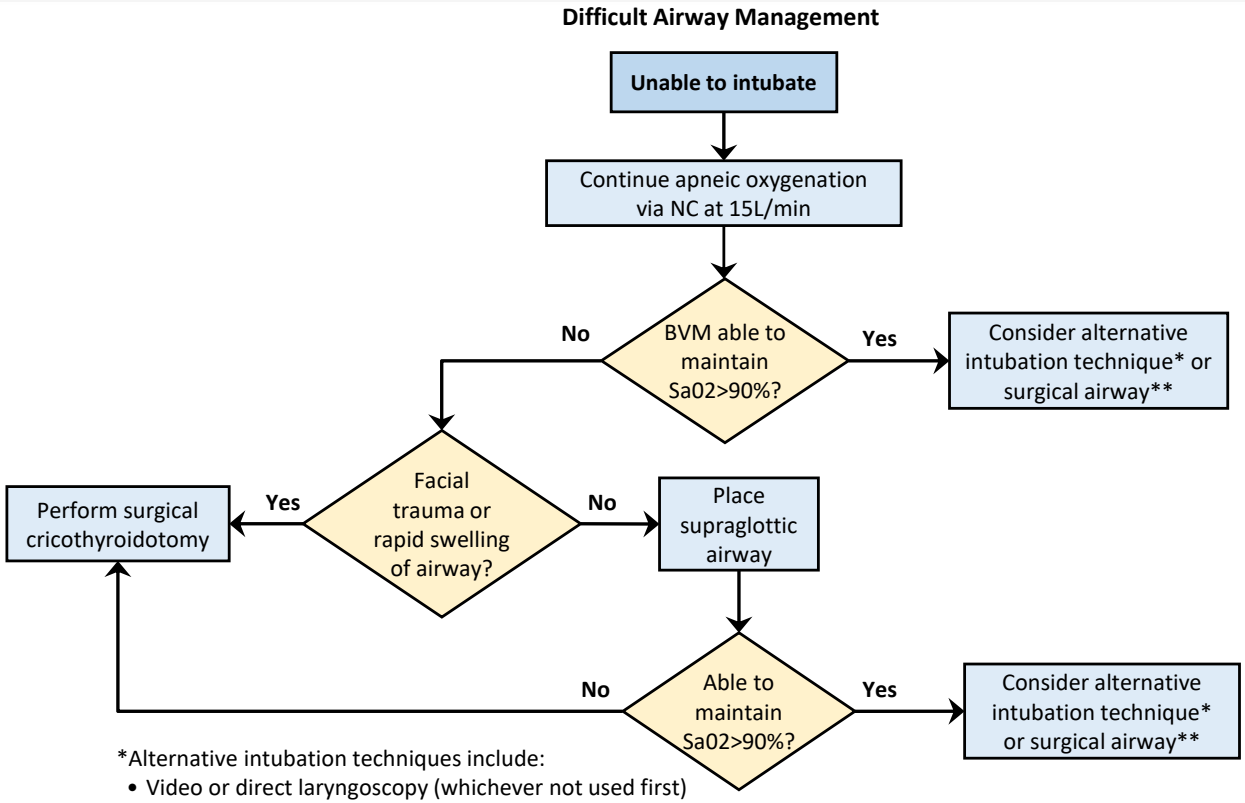
## Unable to Intubate: Can you Mask Ventilate?

**Mask Ventilation Pearls**
- Skilled operator
- Good seal
- Jaw thrust
- Oral airway
- Nasal airway(s)
- Two operator mask ventilation

| | |
|---|---|
| **YES** | ▪ Improve position, change blade/operator, laryngeal manipulation technique, gum elastic bougie.<br>▪ Attempt alternate technique: Fiber optic, video laryngoscope, tracheal trans illumination device.<br>▪ More than ≈ 3 attempts at intubation may abolish your ability to mask ventilate due to edema caused by laryngoscopy.<br>▪ Surgical airway (Cricothyroidotomy or tracheostomy) |
| **NO** | ▪ Emergency pathway...seconds matter.<br>▪ Supraglottic airway or<br>▪ Surgical cricothyroidotomy |

Defense Health Agency

# Airway Trauma Management




*Alternative intubation techniques include:

- Video or direct laryngoscopy (whichever not used first)
- Fiberoptic scope
- Transtracheal illumination device
- Retrograde wire with Magill forceps
- Changing providers

**Surgical airway includes both tracheostomy and surgical cricothyroidotomy will be performed.

# Airway Trauma Management

- Significant Pearls
  - Ketamine is the first line agent for RSI.
  - Apply principles of apneic oxygenation.
  - Utilize device name rather than brand-name when possible.
  - Eliminate blind nasal intubation; anticipate fiber optic guidance.
  - Use waveform or digital capnography as primary tool to verify tube placement.

# Airway Trauma Management

- Significant Pearls (continued)
  - No recommendation for use of an intubating laryngeal mask airway
  - Surgical cricothyroidotomy or tracheostomy are surgical airway options.
  - Separate traumatic brain injury algorithm not required.
  - Pediatric patients have alterations to the main algorithm.
  - Trauma airway management should be rehearsed with your trauma team on a regular basis.

# PI Monitoring

- **Intent (Expected Outcomes)**
  - All injured patients who present with obtundation (GCS<8), apnea, respiratory distress or insufficiency, airway obstruction, or impending airway loss will have a secure and definitive airway established expeditiously upon arrival to a theater Military Treatment Facility (MTF).
  - A definitive airway may have been established in the prehospital setting by an appropriately trained and experienced provider in accordance with airway management guidelines established by the Committee of Trauma Combat Casualty Care, and proper position should be verified upon arrival to the MTF.
- **Performance/Adherence Measures**

  All patients meeting the above criteria had a secure and definitive airway either expeditiously established or verified upon arrival to a theater MTF.
- **Data Source**
  - Patient Record
  - DoD Trauma Registry (DoDTR)
  - Nursing MAR

# References (1 of 2)


1. Eastridge BJ1, Mabry RL, Seguin P,Cantrell J, Tops T, Uribe P, Mallett O, Zubko T, Oetjen-Gerdes L, Rasmussen TE, Butler FK, Kotwal RS, Holcomb JB, Wade C, Champion H, Lawnick M, Moores L, Blackbourne LH. J Trauma Acute Care Surg. 2012 Dec;73(6 Suppl 5):S431-7. doi: 10.1097/TA.0b013e3182755dcc.
2. Levitan R, Wayne P. Guide to Intubation and Practical Emergency Airway Management. Pennsylvania: Airway Cam Technologies, Inc.; 2004.
3. Weingart, Levitan. Preoxygenation and prevention of desaturation during emergency airway management, Annals of EM, Vol 59, No 3, March 2012.
4. Gofrit et al. Ketamine in the field, Injury Vol 28, No 1, pp 41-43, 199
5. Sehdev et al. Ketamine for RSI in pots with head injury. Emergency Medicine Australasia (2006) 18, 37-44.
6. Weingart et al. Delayed Sequence Intubation. Annals of EM, Vol 65, No 4, April 2015
7. Griesdale et al, Glidescope vs DL: systematic review and meta-analysis, Can J Anesth (2012) 59:41-52
8. McMullan et al. Prevalence of prehospital hypoxemia and oxygen use in trauma patients. MilMed, Vol 178, Oct 2013.
9. Wimalasena et al. Apneic oxygenation…. Annals of EM. Vol 65, No 4, April 2015.
10. Ellis et al. Cricoid pressure in ED RSI: Risk-Benefit, Annals of EM, Vol 50, No 6: Dec 2007.

# References (2 of 2)


11. Harris et al. Cricoid pressure and laryngeal manipulation in 402 pre-hospital emergency anesthestics, Resuscitation, 81 (2010) 810-816.
12. Seder et al. Emergency Neurological Life Support: Airway, Ventilation, and Sedation. Neurocrit Care (2012) 17:S4-S20.
13. Swadron et al. Emergency Neurological Life Support: TBI. Neurocrit Care (2012) 17: S112-S121.
14. McGill. Airway Management in Trauma: An Update. Emerg Med Clin N Am 25 (2007) 603-622.
15. Defense Health Board, Combat Trauma Lessons Learned from Military Operations of 2001-2013, Mar 9, 2015
16. Martin MJ, Beekley A. Front Line Surgery: A Practical Approach. New York: Springer Publishing Inc.; 2011.
17. Borden Institute (U.S.). Emergency war surgery. Fourth United States revision. ed.
18. Nakstad, Anders R., Per P. Bredmose, and Mårten Sandberg. "Comparison of a percutaneous device and the bougie-assisted surgical technique for emergency cricothyrotomy: an experimental study on a porcine model performed by air ambulance anaesthesiologists." Scandinavian journal of trauma, resuscitation and emergency medicine 21.1 (2013): 1-8.
19. Reardon, Rob, Scott Joing, and Chandler Hill. "Bougie-guided Cricothyrotomy Technique." Academic Emergency Medicine 17.2 (2010): 225-225

# Appendices

- **Appendix A**: Trauma Airway Assessment
- **Appendix B**: Difficult Airway Management Algorithm
- **Appendix C**: Additional Information Regarding Off-Label Uses in CPGs

# Contributors

- CDR Benjamin Walrath, MC, USN
- MAJ Stephen Harper, MC, USA
- Surg Lt Cdr Ed Barnard, MD, Royal Navy
- CDR Joshua M. Tobin, MC, USN
- CDR Brendon Drew, MC, USN
- LTC Cord Cunningham, MC, USA
- Col Chetan Kharod, MC, USAF
- CDR James Spradling, NC, USN
- Major Craig Stone, MD, FRCPC, Canadian Forces
- COL Matthew Martin, MC, USA

Slides: Maj Andrew Hall, MC, USAF

Photos are part of the JTS image library unless otherwise noted.