



## The Art of the Airway: Virginia EMS Symposium 2013

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## Objectives:

- Refine Approach to Airway Situations
- Develop Airway Decision Making
  - "Airway Manager Philosophy"
  - Predict the Difficult Airway
- Discuss Interventions
  - More is not always better
  - "First pass" mindset

## Challenges in EMS Airway Management

- Are we any good at it?
- Does it matter?
  - "C-A-B"
- Gold Standard?
  - Ventilation or Intubation?
- Outcomes:
  - Does the patient leave the hospital?
  - Did we contribute to harm?

## Airway Interventions in EMS

- Basics
  - Bag-valve-Mask
  - Oral/Nasal Airways
- Advanced
- Critical Care?

## Airway Management Review

- Airway Maintained?
  - Reposition? Adjunct needed?
- Breathing Spontaneously?
  - Quality?
- Interventions Needed?
- Effective Interventions?

## The Airway Manager (YOU)

- MOST important variable in successful airway management
- Develop methodical, systematic approach
- DOES NOT getting every intubation
- DOES mean you control the situation
- WRANGLER of CHAOS

## Becoming an Airway Manager

Recognition is only the beginning  
Traditional approach is skill based

## Patient Factors in airway management

- Sick versus NOT Sick: What is Needed
- Clinical Progression: Where is the situation headed?
- Intervention Progression:
  - Basic to Advanced
- Are interventions:
  - 1) Appropriate to situation?
  - 2) Working as intended?

## System Factors in Airway Management

- Basic and Advanced Levels
  - Based on National and State Scope of Practice
- Protocols
  - Advanced scope of practice
- Transport method and distances
- Hospitals: Available resources

## System Factor

- Intermediates no longer able to Intubate Pediatrics less than 12
- Paramedic level for:
  - Surgical and Percutaneous cricothyrotomy
  - Medication assisted intubation/Paralytics

## Educational Factor

- Fewer Opportunities for EMS Students to get exposed to Airway situations

## Personal Factors

- Training: What you have been taught
- Competence: What you prove you can perform
- Experience: How many times you perform the skills
  - *Often more than just the number of times...*
- Confidence:
- Willingness:

## Evidence: A Mixed Bag world wide

- Past 10 years: VAST INCREASE
  - Number and Quality of Studies
  - Number of Airway Options
- Significant Scrutiny to EMS Airway TECHNIQUE and PROCEDURE
  - Goal: Do NO harm
  - Especially in pediatrics
- Focus on OUTCOMES

## Articles

- *Resuscitation (2011 to 2013)*
- *Emergency Medicine News*
- *The Journal of Emergency Medicine*
- *Annals of Emergency Medicine*

## Evidence:

- EMS Outcomes:
  - Canada: (Tallon, et al 2013) ED intubation with better outcomes than Prehospital (observational study)
  - Cardiac Arrest as complication of RSI and intubation (1 in 25) (Heffner, et al 2013)
  - Less is More: BVM better over ETI and SGA (Baude 2013)

## Evidence: Supraglottic airways

- Easier to place: (Reiter 2013)
- Faster
- Requires less skill; skill retention is better
- Carotid blood flow may be decreased
  - "Pig Study" (Segal 2012)

## Evidence: ET vs SGA

- No significant difference in:
  - Success Rates (~80%)
  - Median time to placement (@ 20 seconds)
- (Frascone, et al 2011)

## Evidence: EMS Endotracheal Intubation

- ETI associated with better outcomes over SGA (Wang, et al 2013)
- Less experience equals lower success rates (Ruetzler 2011)
- NOT recommended in children due to complications (Gerritse, et al 2011)

## Making Decisions Thinking without Thinking

- Malcolm Gladwell: Author and philosopher
  - *Blink: The Power of Thinking Without Thinking*
  - *The Tipping Point: How Little Things Can Make a Big Difference*
- “Thin Slicing”
- Avoiding group think and traps of overconfidence

## Successful Decision Making

From *Blink* by Gladwell

- Balance deliberate and Instinctive decision making
- Thin Slicing:
  - “The ability of our unconscious to find patterns in situations and behavior based on very narrow slices of experience”-Gladwell

## Successful Decision Making

From *Blink* by Gladwell

- Frugality Matters:
- Take the complex problem and reduce it to the simplest elements
  - What is the problem and FIX IT!
  - Do not get caught up in the “Production of Information”
  - Avoid Analysis Paralysis

## Training Factors, Building Competence

- Repetition
  - Basics, basics, basics
  - “Basics” of advanced skills
- Building muscle memory
  - Skills: remembered, retained
- Finesse:
  - Sight picture
  - Hand placement
  - Blade choice

## Mindset!!

- **Maintain Oxygenation and Ventilation**
- Intubation is not as important as basic airway skills
- “Devices” in many capacities associated with complications
  - Including video laryngoscopy and bougie

## Separating the “Exceptional” from “Ordinary”

- Finesse
- Polish
- Approach
- Continuity
- Choices

## Initial Assessment

- Basics:
  - Scene survey, clues
- General Impression
  - Conditions
- Sick versus Not-sick
- Actions needed?

## What are your key actions?

- An unconscious trauma patient, snoring and slow respirations
- Semi-conscious patient, gurgling and rapid respirations
- Cardiac Arrest patient-AED in place
- Conscious child with high pitched, barking respirations

## Situations:

- Would these change your decisions?
  - Asthma patient versus cardiac arrest
  - Diabetic versus new seizure
  - Trauma versus medical
- There is NO single, decisive solution..
  - Adapt to problem

## Critical Decision Making

- Is airway intervention needed?
  - What type or level of airway intervention is needed?
- Starting simple, are the interventions working?
  - Always re-evaluate what you have done
- Can the airway be maintained?
  - Patient movement can compromise the airway
- Rescue Airway needed?
  - All other efforts failed..

## Critical Decision Making

- Boyd's Loop
  - Colonel John Boyd, USAF Fighter Pilot
  - "OODA Loop"

**Observe**

**Orient**

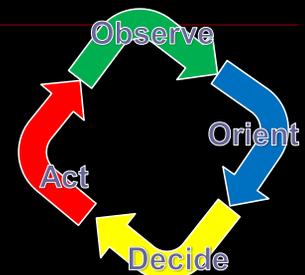
**Decide**

**Act**



## Boyd's Loop

- Continuous
- Feedback
- Key:
  - Move through



## Elements of Basic Airway

- Positioning
- Bag-Valve-Mask Technique
  - Critical Skill: Key Points?
- Adjuncts:
  - Oral versus Nasal

## Developing Skills

- Experience builds habits
  - Voluntary actions
  - Decisions
- Repetition builds muscle memory
  - Making a voluntary function automatic

## Three Dimensions of Difficult

- Difficult to Oxygenate and Ventilate
- Difficult to Intubate
- Difficult to perform cricothyroidotomy
- Difficult Extraglottic device

From the "Manual of Emergency Airway Management", Third Edition, by Walls, et al.

## Predict the Difficult

- **MOANS**: Difficult to bag-valve-mask ventilate
- **LEMON**: Difficult to visualize and intubate
- **SHORT**: Difficult to perform a surgical cricothyroidotomy
- **RODS**: Difficult extraglottic device

From the "Manual of Emergency Airway Management", Third Edition, by Walls, et al.

## MOANS

- **M** -Mask seal: facial features
- **O** -Obesity/Obstruction: large BMI
- **A** -Age: greater than 55
- **N** -No teeth: support anatomy
- **S** -Stiff: COPD, high airway pressures

## LEMON Law

- **L** -Look externally
- **E** -Evaluate the 3-3-2 rule
- **M** -Mallampati Scale (Class I to IV)
- **O** -Obstruction
- **N** -Neck Mobility

## SHORT

- S - Surgery or airway disruption
- H - Hematoma
- O - Obesity/landmark identification
- R - Radiation distortion
- T - Tumor

## RODS

- Restricted Mouth Opening
- Obstruction
- Disrupted or distorted airway
- Stiff: Lungs or cervical spine

## Airway Images

- Google sources

## Is this a difficult airway?



## What are the challenges?



Angioedema: Swelling

Destruction of features



## What?



## Working the basics...



## Difficult Airway



## Tangible Techniques

- Approaching to the Airway
- Positioning
- Ventilation Skills
- Basic Adjuncts
- Advanced Adjuncts

## Developing Skills

- Experience builds habits
  - Voluntary actions
  - Decisions
- Repetition builds muscle memory
  - Making a voluntary function automatic

## BURP Maneuver

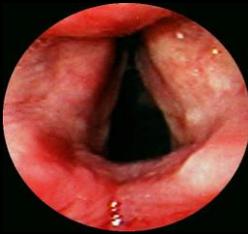
- Backward, Upward, Rightward Pressure
- Applied to thyroid cartilage by intubating medic's right hand or by an assistant.
  - ELM-External Laryngeal Manipulation
- Designed to help align vocal cords and trachea
- Used with cricoid pressure

## Bougie/Introducer

- Smaller diameter
- Useful for partial visualization
- Teamwork required: pass tube
- "Extra steps"

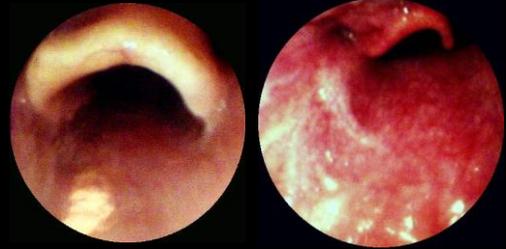


## Sight Picture

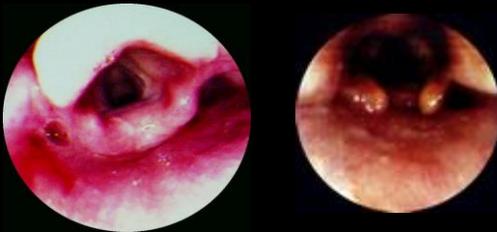


- Blade Control
- Tongue Control
- Landmarks

## Would you intubate this?



## Would you intubate this?



## Is intubation possible?



Is Oxygenation an option?

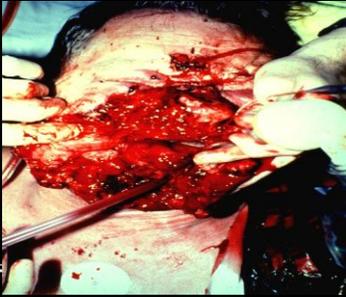
## Nasal Intubation: The LOST ART

- Blind insertion, requires breathing patient
- Replaced by CPAP and RSI as options
- Two outcomes:
  - Works like a charm
  - Miserable MESS!
- Loathed by nurses and respiratory therapists

## Rescue Airways: Plan B, C, and D

- Difficult conditions
  - Intubation attempts have failed
  - Conventional Intubation not safe or delay care
- Complement, but do not replace endotracheal intubation skills
- Less invasive vs. more invasive
  - King LTS Airway
  - Surgical Cricothyrotomy

Yep, probably so...



## Confirmation of Intubation

- "Gold Standard" is direct visualization
- Capnography
- Clinical Findings

Every available  
method to verify the  
tube placement  
should be used!!!!

## Capnography 2013

- AHA Guidelines
  - Class I, LOE A
  - 100% Sensitive, 100% Specific
- Quantitative, continuous, waveform capnography
  - Monitor position of airway devices
  - Quality of CPR
- "CAB"
  - Circulation-Airway-Breathing

## Capnography

- ALL patients requiring Airway Management
  - Guides resuscitation
  - Quality of ventilations
- REQUIRED for Advanced Airways
  - Endotracheal Tubes
  - King
  - Surgical Airway

## Capnography

- Quantitative, graphical measurement of **EVERY INTUBATED PATIENT..**
- American Society of Anesthesiologists (ASA) standards:
  - **Continuous Monitoring..** Every patient receiving anesthesia shall have adequacy of ventilation monitored by continuous measurement of expired carbon dioxide shall be performed unless invalidated by the nature of patient, procedure, or equipment
  - Continual EtCO<sub>2</sub> analysis, in use from the time of ET placement, until extubation/removal or transfer ... shall be performed using a quantitative method such as capnometry, or mass spectrometry

## INTANGIBLE Techniques: Mindset!!

- **Maintain Oxygenation and Ventilation**
- Intubation is not as important as basic airway skills
- “Devices” in many capacities associated with complications
  - Including video laryngoscopy and bougie

## Let’s Address RSI a little...

- And try to keep in the neutral pathway for the OMD’s...
- Outlines the most challenging decision we make about a patient...
- Integrates our critical tactile skills
  - Intubation

## RSI is to EMS

What **Use of Force** is to Law  
Enforcement

## Rapid Sequence Intubation

- **RSI is defined as a technique** where a potent sedative or induction agent is administered virtually simultaneously with a paralyzing dose of a neuromuscular blocking agent **to facilitate RAPID TRACHEAL INTUBATION.**

## “The Decision to RSI”

RSI is a lethal weapon that when practiced, mastered and used appropriately, can be a lifesaver. Alternatively it can result in the swift and unequivocal death of your patient.

Dr. Harinder Dhindsa  
LifeEvac Virginia  
VCU Medical Center

## Prior to RSI

- Nasal intubation common for the breathing patient in need of airway management
- Surgical Airway more common
- Anesthesiologist requested for definitive airway management
- Two medication methods
  - SEDATION only or PARALYTIC only used
  - Both of these techniques have significant complications

## Goals of EMS RSI

- Early and rapid control of the airway in compromised patients
  - Head Injury/ increased ICP
  - Multi-Trauma
  - Respiratory Failure
- Increase success in intubation
  - Create the "optimal" intubating conditions
  - Prevent aspiration

## What RSI is NOT

- Behavior Control
  - Requires differential diagnoses
  - \*there is a balance between what is performed for safety and what is needed to maintain oxygenation\*
- "Simple"
  - Requires complete understanding of the consequences
  - Do not become complacent

## RSI Reality

- Patient population is often sicker if airway intervention required
- Trauma population often more compromised
- There should be NO "elective" RSI in EMS
  - KNOW WHY
- Decisions should be based on sound clinical judgment and experience

## Known Complications of EMS RSI

- Prolonged on scene times
- Higher rates of hypoxia
- Increased incidence of hyperventilation
- Poor documentation
- AND THE KILLER
  - Unrecognized esophageal intubation

## RSI Lessons Learned

- In field, patients requiring this procedure are sicker/more compromised
- Teamwork is *VITAL*
  - Establish a plan and communicate well
  - Control the situation
- Know the pitfalls and what can go wrong.

## RSI Realities

- RSI is more for medical than trauma
  - Trauma has more indications, less opportunity
- Departments will average less than they imagine
  - Once the "novelty" wears off

*It is NOT acceptable to transport a PARALYZED patient without sufficient SEDATION*

How would you like to be AWARE than you cannot breath and had ABSOLUTELY NO CONTROL over your own body?

## RSI Research

- Debate on Efficacy
  - Need versus skill required
- Debate on Medications
  - Induction agent: Etomidate v. Versed
  - Paralytic Agent: Sux v. Roc
  - Combination of Agents superior to sedation alone

## Three Criteria for Intubation

1. Is there a failure of airway maintenance or protection?
2. Is there a failure of ventilation or oxygenation?
3. What is the anticipated clinical course?

From the "Manual of Emergency Airway Management", Third Edition, by Walls, et al.

## 1. Is there a failure of airway maintenance or protection?

- Can "Maintain" a "patent" airway
  - Awake, alert; level of consciousness provides protection against aspiration
- Severely ill, trauma compromised, or otherwise unconscious
  - Protective mechanisms weakened or lost
  - Aspiration = increased morbidity and mortality

## 1. Is there a failure of airway maintenance or protection?

- Gag Reflex Present?
- Physical Destruction of Airway?
- Physiologic compromise?

## 2. Is there failure of ventilation or oxygenation?

- Oxygenation of vital organs: primary function of the respiratory system
  - **Ventilation** is the movement of air/oxygen into the lungs
  - **Perfusion** is the oxygenation of the cells through the alveoli
  - **Gas exchange**: In with the good, out with the bad
    - Is the bad leaving?
- **Ventilation versus perfusion**:
  - Is what you are putting in getting to the cells?

## 2. Is there failure of ventilation or oxygenation?

- Example: Status asthmaticus
  - Protect and maintain their UPPER airway even in extremis
  - Fatigue leads to respiratory failure with resultant hypoxemia
  - Airway and tissue inflammation
- Example: Pulmonary edema
  - Benefit from positive pressure (CPAP, BiPAP)
    - Fluid pushed out of the alveoli
  - Ventilation and perfusion is mis-matched

## 2. Is there failure of ventilation or oxygenation?

- CPAP Trap
- Non-Invasive Ventilation
  - Works when patient breathing
  - Ineffective when ventilations slow from fatigue
- Keen awareness and action early

## 2. Is there failure of ventilation or oxygenation?

- Reversible cause?
- Back to H's and T's from AHA
  - Hypoglycemia
  - Narcotic Overdose
  - Tension Pneumothorax

## 3. What is the expected clinical course?

- Where is this situation going?
- How might the patient deteriorate?
- What will happen at the next level of care?
- Will the work of breathing be overwhelming in the face of multiple, major injuries?
- Are interventions working?

## Examples:

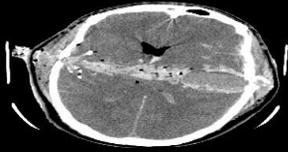
- Trauma
- Burns
- Post-arrest
- Asthma vs. COPD

## 3. What is the expected clinical course?

- 18 year old motorbike racer with a rope injury to his neck
  - Stridorous?
  - Obvious swelling?
  - Able to speak?

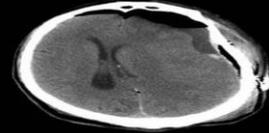
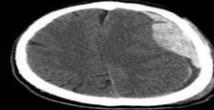


### 3. What is the expected clinical course?



Patient is still breathing?

### What is the expected clinical course?



### 3. What is the expected clinical course?



### Making the Airway Decision

- What do you have?
- What are your resources?

### Case Study 1

- MVC-car into a tractor trailer at interstate speed unrestrained 20 y.o. male driver – steering wheel deformity and windshield starred
- Altered LOC, laceration to face, deformity to left leg, chest tender
- Vitals: BP=100/60, HR=136, R=38, SaO2=90%
- GCS E3, M5, V3,



### Case Study 2



- Female patient found unresponsive in bathroom
- Left side posturing, right side flaccid
- Vitals: R=8 irregular and gurgling, BP=170/110, HR=56, SaO2=92% on room air
- Left pupil dilated

### Case Study 3

- 56 year old obese male with lower extremity paralysis from motorcycle accident. No other apparent injury
- Vitals: 162/76, 24, 110, 96% on room air
- GCS: E4, M6, V4
- Patient is complaining of extreme lower back pain and is agitated and combative.

### Case Study 4



- MVC, single patient restrained driver
- Altered LOC
- Injuries to match mechanism
- Entrapped in cab

### Indication for Airway Management?



### Case Study 4

- Rapid Extrication
- BLS measures
  - O2
  - NP
  - Suction
- Obvious facial injuries
- Vitals:
  - HR=110, BP=150/100
  - R=12, SaO2=95%
  - GCS=E2, M3, V2



### Case Study 5

- MVC-car into a tree 45 mph,
- Patient=unrestrained, 18 y.o. driver
  - steering wheel deformity and windshield starred
  - Vitals: BP=140/92, HR=136, R=38
  - GCS E3, M6, V4
- Awake-c/o severe right sided chest pain
- Slurred speech, 5 cm laceration to mid forehead-bleeding controlled, right ant. Chest tender to palpation, left side lung sounds diminished

### Case Study 6

- 24 year old asthmatic patient in ED
- Prior history of intubation
- On continuous albuterol nebulizers, plus steroids (enter your asthma protocol)
- No longer in tripod position, still has accessory muscle use, eyes glassy
- Vitals: BP=100/40, HR=140, R=16\*, SaO2=91% with NRB and nebulizer

## Case Study 7

- Male patient with gunshot to face
  - Entry and exit wounds in cheeks
  - Obvious destruction of upper palate
- Awake, responsive to commands, cannot communicate verbally
  - Swelling in face, early signs of raccoon's eyes
- Vitals:
  - HR=100, BP=132/68, SaO2=100% w/NRB

## Case Study 8

- MVC: mini-van pulled in front of tractor trailer
- Male patient unconscious, airway opened by police
- Vitals: BP=90/p, HR=140, R=8 irregular, SaO2=UTO
- Trapped by lower extremities
  - Extended extrication



## Case Study 8 Complications

- Patient required repackaging prior to RSI (Delay)
- Intubation was single attempt
  - confirmed by visualization, auscultation, and **qualitative** End-tidal CO2 detector (colormetric)
- Patient developed **immediate Bradycardia**
  - Required re-confirmation of ET placement
  - Atropine 0.5mg administered
  - Ventilation volume increased
- Ventilator stated increased difficulty in bagging
  - Bilateral needle decompression

## Case Study 9

- 65 year old respiratory distress
- Tachycardic, Tachypneic, Hypertensive
  - Marked increased work of breathing
  - Cyanotic
- History of COPD and CHF
- Treatments:
  - CPAP
  - Nebulizer beta-agonists (Albuterol/Atrovent combo)
  - Transdermal veno-dilators (Nitroglycerin)

## Case Study 9



## Case Study 9

- CPAP: Respirations decrease
- Level of Consciousness decreases?
  - Sleeping?
- Is patient better?
- Clinical Course?

## Case Study 10

- 52 year old Asthmatic:
- Initial TX: Oxygen and Nebulizer treatment
- Arrest: Patient apneic and pulseless
  - PEA: slow rate of 40
  - Compressions and BVM, IO access and meds
  - King Airway inserted
  - Capnography of 55mmHg, large waveform
- Difficult to bag with King; no pulses still

## Case Study 10

- What is the problem?
  - Failure: Airway maintenance?
  - Failure: Oxygenation and ventilation?
  - Clinical Course?
- Crew Actions:
  - EXCHANGE King Airway for oral endotracheal tube via direct visualization and bougie
  - Increase rate and volume (TIGHT to bag)
  - Improved heart rate and capnography

## Case Study 11

- Ventilator dependent pediatric
  - Trach dislodged and unable to replace
- Thick, tenacious green secretions..
  - EMS choices?
    - Oral intubation?

## Indication for Airway Management?



## The Airway Plan: 7 P's Modified

- **Prepare:** yourself, your equipment, and your patient
- **Pre-oxygenated:** QUALITY, not quantity
- **Position with protection:** patient and provider; cricoid pressure
- **Plan:** *If this, then that*
- **Perform and place:** watch tube go through the cords
- **Proof:** Capnography
- **Post-intubation management:** ETT holder and c-collar

## Summary

- Airway is MORE than just skill
- The WHOLE of skills, experience, and application is essential
- Science versus Art
  - The Art of Medicine..

## Reasons why...

- From entrapped in an accident...



- ... To walking across the stage for graduation

## Personal Credits for pictures and Information:

- Chief Jethro Piland
  - Hanover Fire EMS
- Dr. Harinder Dhindsa,
  - VCU Medical Center
  - OMD, LifeEvac Virginia
- John Green, Chesterfield Fire EMS
  - Flight Paramedic, EMS Medflight 1
- Hanover Fire EMS RSI Program

## Sources:

- Walls, et al. *Manual of Emergency Airway Management*. 3<sup>rd</sup> Edition. Philadelphia: LWW, 2008.
- Bledsoe, et al. *Prehospital Emergency Pharmacology*. Fifth Edition. Brady, 2001
- Bledsoe, Brian. The Disappearing Endotracheal Tube
- Wang, et al. "Drug Assisted Intubation in the Prehospital Setting." *Prehospital Emergency Care*. Volume 10/Number 2 (2006): 261-271

## Sources:

- Blaber, P. (2008). *The Mission, the Men, and Me*. New York: Berkley Caliber.
- Braude, MD, EMT-P, D. (2013, April). Arrest Ventilation: Is Less More? *Emergency Medicine News*, 35(4), pp. 1, 28.
- Carlson, J. N., & Wang, H. E. (2013). Emergency Airway Management: Can we do better? *Resuscitation*, 84, 1461-1462.
- Comparison of prehospital insertion success rates and time to insertion between standard endotracheal intubation and a supraglottic airway. (2011). *Resuscitation*, 82, 1529-1536.
- Gerritse, B., Th Draaisma, J. M., Schalkwijk, A., van Grunsven, P. M., & Jan Scheffer, G. (2008). Should EMS-paramedics perform paediatric tracheal intubation in the field. *Resuscitation*, 79, 225-229.
- Gladwell, M. (2002). *The Tipping Point*. New York, NY, USA: Back Bay Books/ Little, Brown, and Company.
- Gladwell, M. (2005). *Blink*. New York, NY, USA: Back Bay Books/Little, Brown, and Company.

## Sources:

- Heffner, A. C., Swords, D. S., Neale, M. N., & Jones, A. E. (2013). Incidence and factors associated with cardiac arrest complicating Emergency Airway Management. *Resuscitation*, 84, 1500-1504.
- Reiter, D. A., Strother, C. G., & Weingart, S. D. (2013). The quality of cardiopulmonary resuscitation using supraglottic airways and intraosseous devices: A simulation trial. *Resuscitation*, 84, 93-97.
- Ruetzler, K., Roessler, B., Potura, L., Priemayr, A., Robak, O., Schuster, E., et al. (2011). Performance and skill retention of intubation by paramedics using seven different airway devices—A manikin study. *Resuscitation*, 82, 593-597.
- Segal, N., Yannopoulos, D., Mahoney, B. D., Frascione, R. J., Matsuura, T., Cowles, C. G., et al. (2012). Impairment of carotid artery blood flow by supraglottic airway use in a swine model of cardiac arrest. *Resuscitation*, 1025-1030.
- Shah, K., Kwong, B. M., Hazan, A., Newman, D. H., & Wiener, D. (2011). Success of the Gum Elastic Bougie as a Rescue Airway in the Emergency Department. *The Journal of Emergency Medicine*, 40(1), 1-6.

## Sources:

- Tallon, J. M., Flowerdew, G., Stewart, R. D., & Kovasc, G. (2013). Outcomes in Seriously Head-Injured Patients Undergoing Pre-Hospital Tracheal Intubation vs. Emergency Department Tracheal Intubation. *International Journal of Clinical Medicine*, 4, 78-85.
- Voscopoulos, C., Barker, T., Listwa, T., Nelson, S., Pozner, C., Liu, X., et al. (2013). A Comparison of The Speed, Success Rate, and Retention of Rescue Airway Devices placed by First Responder Emergency Medical Technicians: A High Fidelity Human Patient Simulation Study. *The Journal Of Emergency Medicine*, 44(4), 784-789.
- Wang, H. E., Szydio, D., Stouffer, J. A., Lin, S., Carlson, J. N., Vaillancourt, C., et al. (2012). Endotracheal intubation versus supraglottic airway insertion in out-of-hospital cardiac arrest. *Resuscitation*, 83, 1061-1066.
- Weingart, S. D., & Levitan, R. M. (2012, March). Preoxygenation and Prevention of Desaturation During Emergency Airway Management. *Annals of Emergency Medicine*, 59(3), 165-175.

