



# The Art of the Airway:

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# Objectives:

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- 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

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- 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

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

# Airway Management Review

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

# The Airway Manager (YOU)

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- MOST important variable in successful airway management
- What this means:
- Control the situation
- *WRANGLE the CHAOS*
- *DOES NOT MEAN EVERY INTUBATION IS SUCCESSFUL!*
  - *Ouch!*

# Patient Factors in airway management

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- 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

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- 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

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- Intermediates/AEMT
  - Do not intubate Pediatrics less than 12
  - (How often do we intubate pediatrics?)
- Paramedic level for:
  - Surgical and Percutaneous cricothyrotomy
  - Medication assisted intubation/Paralytics

# Educational Factor

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

# Personal Factors

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- 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

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- 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

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

# Evidence:

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## ■ 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

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- 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

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

# Evidence:

## EMS Endotracheal Intubation

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- ETI associated with better outcomes over SGA (Wang, et al 2013)
- Less experience equals lower success rates (Ruetzler 2011)
- Procedural Experience limited (Wang, et al 2004)
- NOT recommended in children due to complications (Gerritse, et al 2011)

# Intubation Safety

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- Study in Norway
  - EMS in Europe is heavily physician
  - Compared physician with non-physician EMS providers
  - Fewer failures by physicians

# Successful Decision Making

From *Blink* by Gladwell

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- 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

# Training Factors, Building Competence

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

# Initial Assessment

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

# Situations:

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- 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

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- 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

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

***Observe***

***Orient***

***Decide***

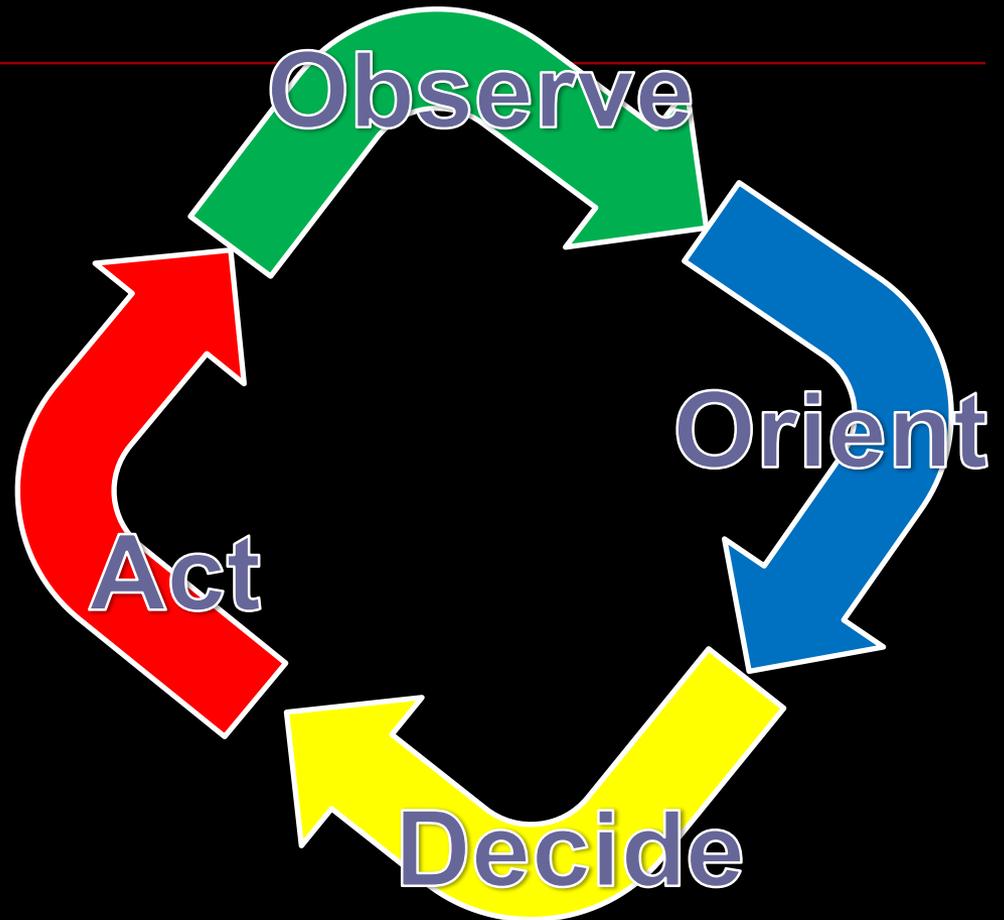
***Act***



# Boyd's Loop

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- Continuous
- Feedback
- Key:
  - Move through



# Elements of Basic Airway

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

# Developing Skills

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

# INTANGIBLE Techniques: Mindset!!

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- ***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

# Three Dimensions of Difficult

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- 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

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- **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

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- **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

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

# SHORT

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

# RODS

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- R - Restricted Mouth Opening
- O - Obstruction
- D - Disrupted or distorted airway
- S - Stiff: Lungs or cervical spine

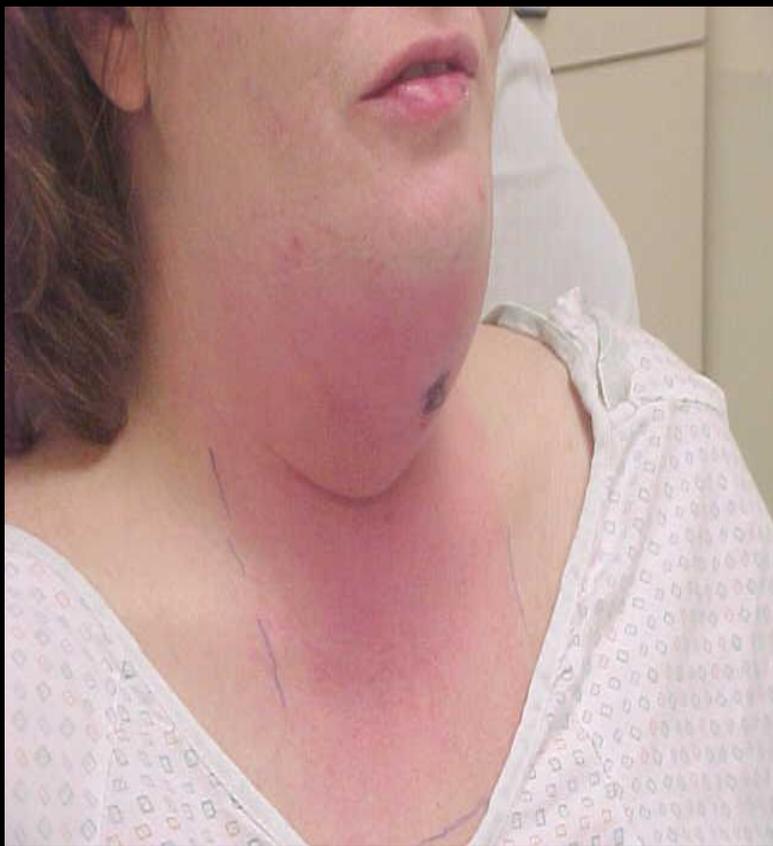
# Airway Images

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- Google sources

# Is this a difficult airway?

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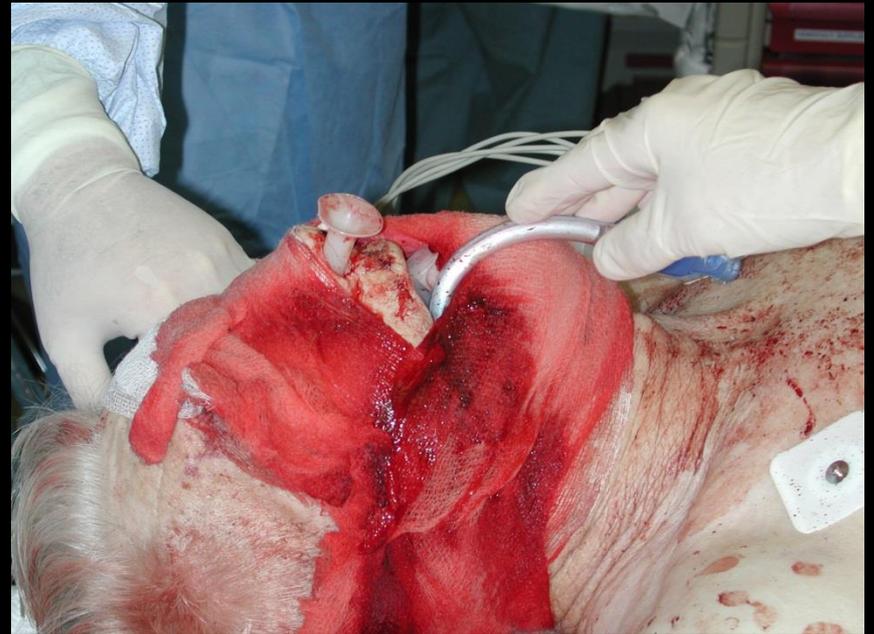
# What are the challenges?

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Angioedema: Swelling

Destruction of features



# What?

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# Working the basics...

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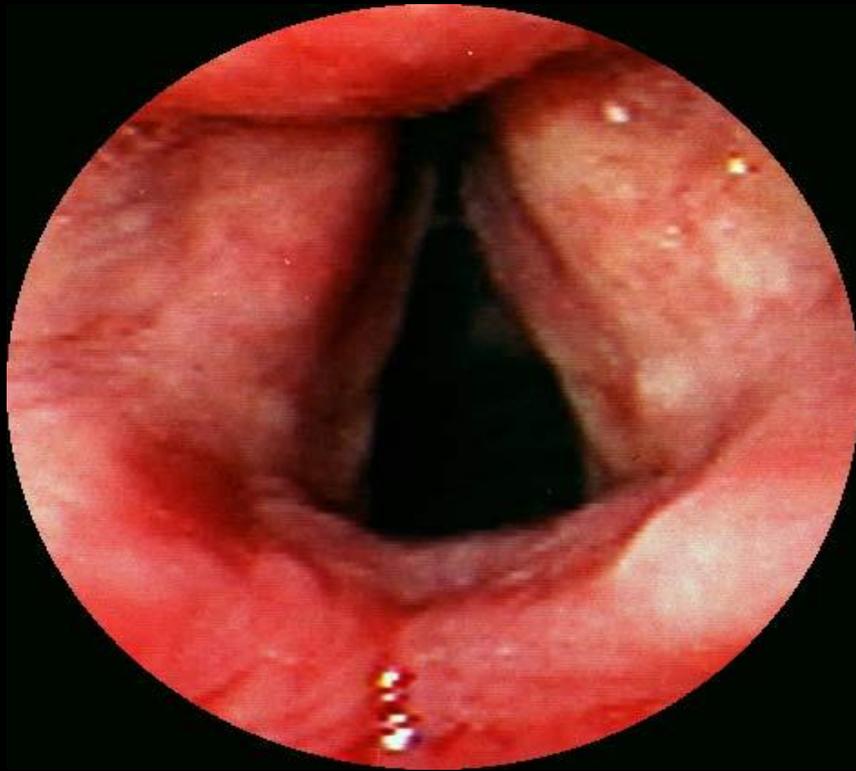
# Difficult Airway

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# Sight Picture

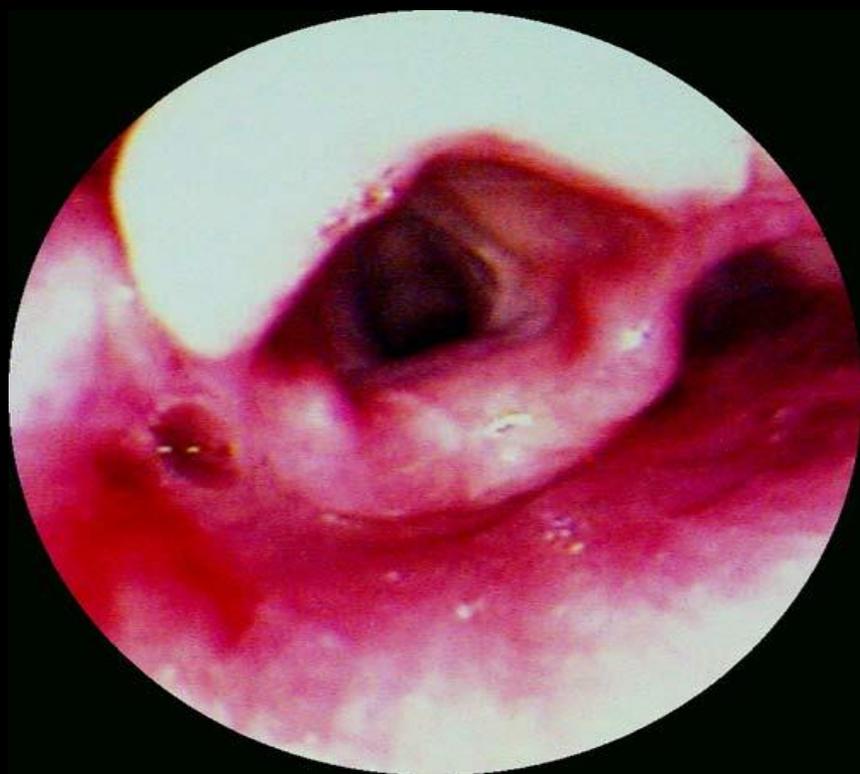
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- Blade Control
- Tongue Control
- Landmarks

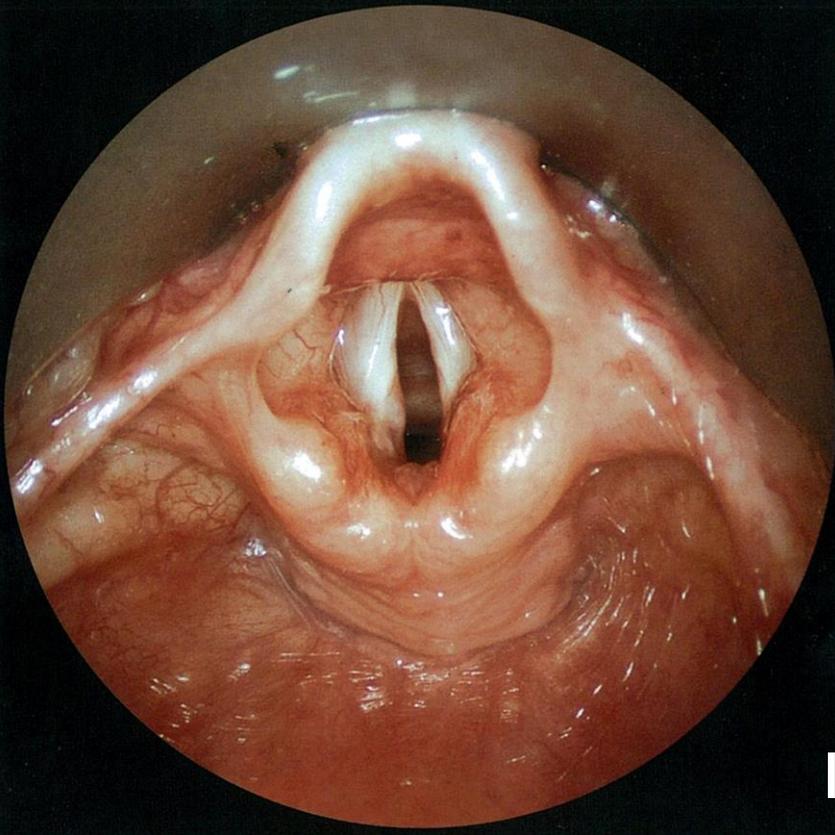
Would you intubate this?

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# Is intubation possible?

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Is Oxygenation an option?

Would you intubate this?

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# Airway Techniques

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- Positioning
- Ventilation Skills
- Basic Adjuncts
- Advanced Adjuncts
  - Bougie
- Advanced Tools
  - Video Laryngoscopy

# BURP Maneuver

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- 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

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



# Nasal Intubation: The LOST ART

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- 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

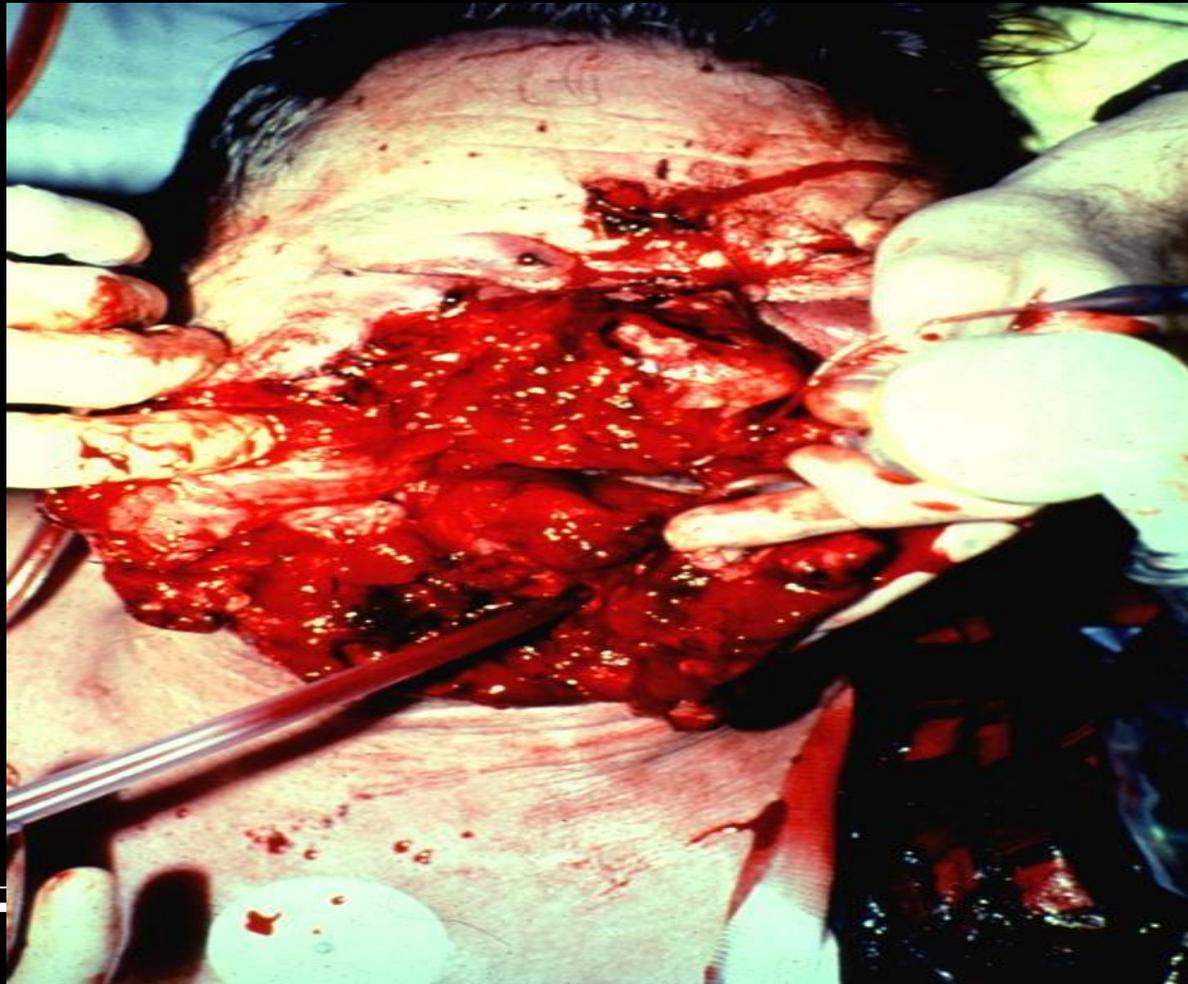
# Rescue Airways: Plan B, C, and D

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- 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 Cricothyroidotomy

Yep, probably so...

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# Confirmation of Intubation

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- “Gold Standard” is direct visualization
- Capnography
- Clinical Findings
- Every available method to verify the tube placement should be used

# Capnography 2014

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- 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

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

# Bougie introducer

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- Preload, or not?
- Feel tracheal rings, or not?
- Curl it into a circle in your kit, or leave it flat in the cabinet?

# Capnography

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- Quantitative, graphical measurement of **EVERY INTUBATED PATIENT..**
- American Society of Anesthesiologists (ASA) standards:

- *Every patient receiving anesthesia shall have adequacy of ventilation continually evaluated*
- *Continual monitoring for the presence 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 capnography, capnometry, or mass spectrometry*

**Quantitative..**

# Video Laryngoscopy

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- No fancy pictures, go see the vendor..
- Will the device survive in your environment?
  - Firefighter proof?

# Video Laryngoscopy

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- Pros:

- Visual record of procedure

- Cons:

- Techniques change
- May not physically work with every patient
  - How many blades in your intubation kit?

# RSI is to EMS

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What *Use of Force* is to Law  
Enforcement

# Rapid Sequence Intubation

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- **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.**

# Prior to RSI

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- 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

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- 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

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## ■ 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

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- 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

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

# RSI Lessons Learned

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- 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

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- 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***

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

# RSI Research

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- 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

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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?

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- 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?

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

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

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- 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?

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- 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?

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- 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?

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

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

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- 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:

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

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

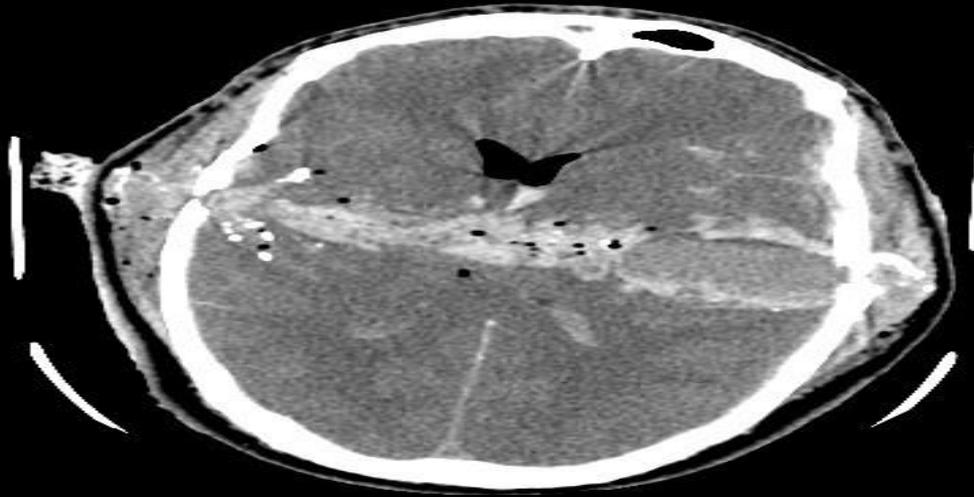
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- 18 year old motorbike racer with a rope injury to his neck
  - Stridorous?
  - Obvious swelling?
  - Able to speak?



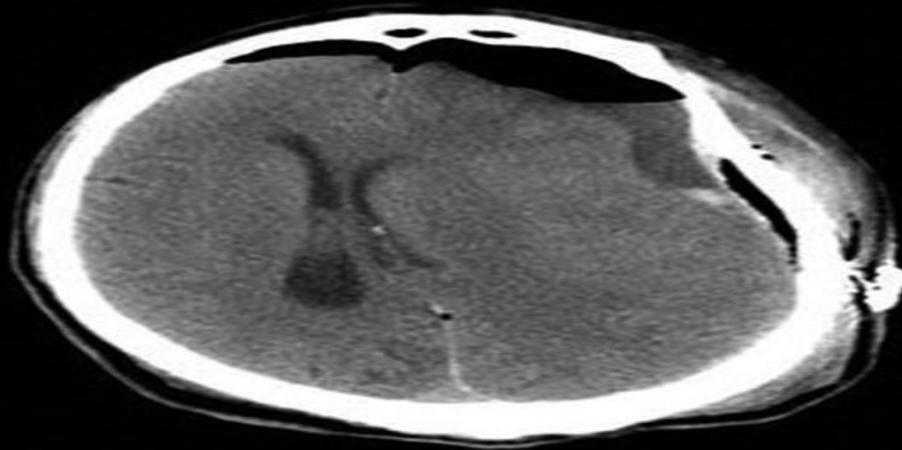
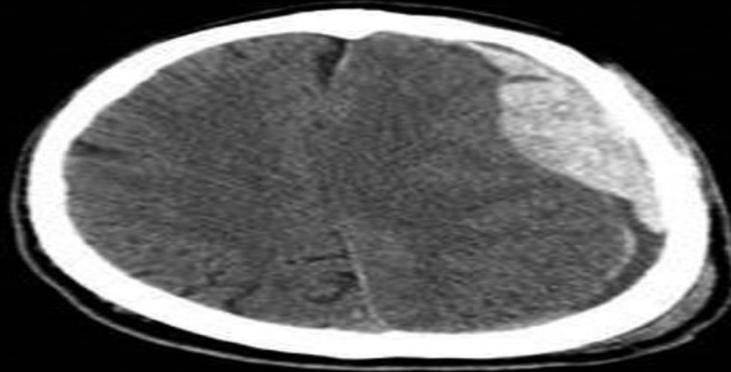
3. What is the expected clinical course?

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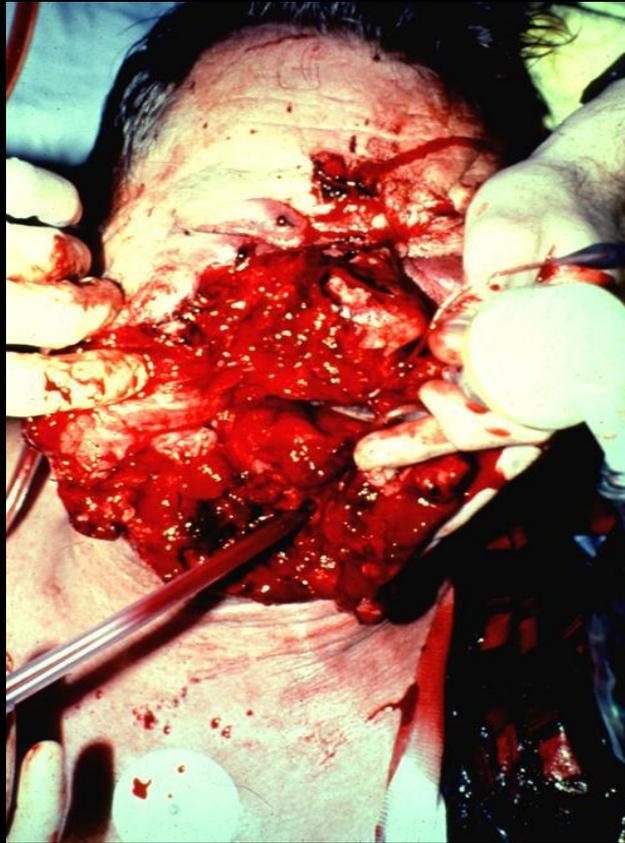
Patient is still breathing?

What is the expected clinical course?



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

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# Making the Airway Decision

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

# The Seven “P’s” of RSI

From *Manual of Emergency Airway Management*, 2<sup>nd</sup> Edition,  
Walls, et al, 2004

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- Preparation
- Pre-Oxygenation
- Pre-Treatment
- Paralysis with induction
- Protection and Positioning
- Placement with Proof
- Post-Intubation Management

# 1. Preparation:

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- Provider
- Equipment
- Patient
- Predict the Difficult Airway

## 2.Pre-Oxygenation

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- Build an Oxygen Reservoir
- Permits several *minutes* of apnea without arterial desaturation
- Time to desaturation depends on many patient factors including pathology
- Essential to a “*NO BAGGING*” principal of RSI (once medications administered)

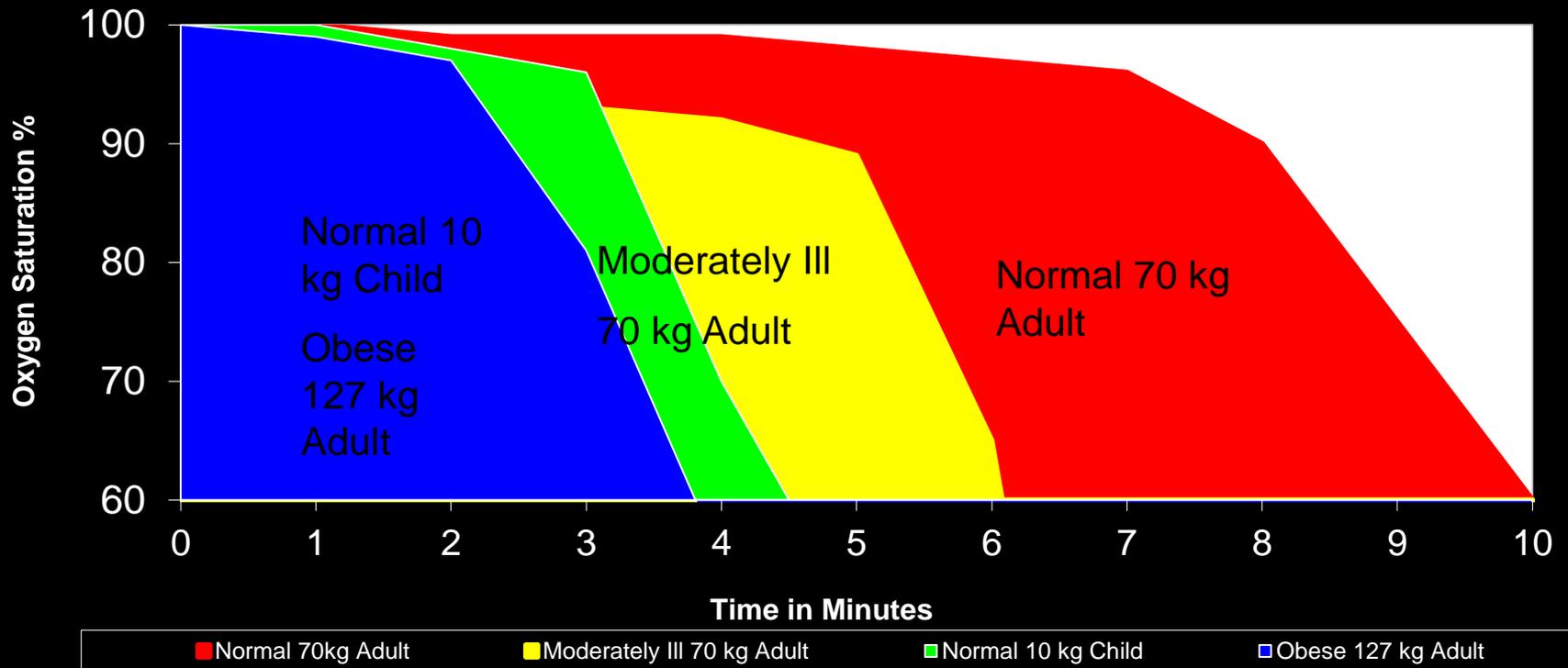
## 2. Pre-oxygenation

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- Functional Residual Capacity (FRC)
  - Principle oxygen reservoir
  - Approximately 30cc/kg
- Goal is to REPLACE predominantly nitrogenous mixture of room air with oxygen
- Start preoxygenation as early as possible
  - Time to ***desaturation*** will depend on the patient.
- Time ... 100-90% vs. 90-0%

# 2. Pre-Oxygenation

Desaturation Curve



# 3. Pre-Treatment

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- Goal:
  - Reduce negative effects of RSI meds and laryngoscopy
- Limited value in Crisis
- Blunt ICP

# 4. Paralysis WITH Induction

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- Sedation agent/amnestic
- Neuro-muscular blockage agent
  - Type dependent on resources
- Doses often weight dependent
- TIME: Onset time key to success
  - Requires WAITING for onset time
- Attempt intubation after complete paralysis

# 5. Protection and Positioning

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- Avoid Bagging/limit gastric insufflation
- Manual stabilization of C-spine
  - Removal of collar permits mandible movement
- Position provider/room to work
- Raise head of stretcher if possible
- Medical: “sniffing position”

## 6. Placement with Proof

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- GOAL: First Pass Success!!
- Direct Visualization
- Capnography Waveform
- Physical Signs
- If BVM measures fail, or King LTD does not provide adequate ventilation, perform immediate surgical cricothyroidotomy

# RESCUE AIRWAY

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- Always have a plan!
- Identify what works.
- Common Rescue Airways:
  - Combitube
  - King LT
  - LMA, I-LMA
  - Surgical Cric should be the last resort.



# 7. Post-Intubation Management

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- Secure ETT with commercial device
  - Thomas or Ambu holders
- Place C-collar to stabilize neck
  - Even in medical cases
- Transport to appropriate medical facility
  - Communicate with hospital early
- **DEFINITIVE CARE**

# 7. Post Intubation Management

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- Pain Management
  - Fentanyl
- Continued Sedation
  - Midazolam if BP tolerates
- Continued Paralysis if needed
  - Extended transport times
- Gastric tube as soon as convenient
  - May be considered early for gastric distention in difficult airway

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

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

# Case Study 1

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- 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

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- Female patient found unresponsive in bathroom
- Left side posturing, right side flaccid
- Vitals: R=8 irregular and gurgling, BP=170/110, HR=56, SaO<sub>2</sub>=92% on room air
- Left pupil dilated

# Case Study 3

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- 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

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

# Indication for Airway Management?

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# Case Study 4

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- 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

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- 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

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- 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\*, SaO<sub>2</sub>=91% with NRB and nebulizer

# Case Study 7

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- 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

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- 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

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- 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

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# Case Study 9

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

# Case Study 10

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- 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

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- 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

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

# The Airway Plan: 7 P's Modified

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- **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

# The decision you make, makes a difference

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Tube or not to tube

King versus ET

BLS or ALS

# Summary

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- 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:

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

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**THANK  
YOU!!!!  
ANY QUESTIONS?**



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