Objectives
- Review scientific lessons from out-of-hospital airway management.
- Review how these lessons apply to Emergency Department (ED) airway management.

The Current Standard...
- Out-of-hospital endotracheal intubation (OOH-ETI) has been practiced by paramedics for a long time.
  - "Standard of care" for over 25 years.
  - "Procedure that defines paramedic level care.

The Problem...
- We have no idea if this intervention actually helps patients.
  - "Saves lives?"
  - "Prevents neurological injury?"
  - "Provides other key benefits?"

The Problem...
- Significant adverse events and errors
  - Previously unrecognized.
  - Life-saving technique may actually pose significant dangers.

Does OOH-ETI Save Lives?
- 11 studies of OOH-ETI and outcome (survival).
- Recurrent theme:
  - OOH-ETI associated with increased risk of death.
  - OOH-ETI associated with poorer neurological outcome.
OOH-ETI and Outcome - Highlights

- Gausche, et. al., JAMA 1999
  - RCT Pediatric ETI vs. BVM, n=830
  - “No difference in survival.”
  - “No difference in neurological outcome.”

- Davis, et. al., J Trauma 2003
  - San Diego RSI Trial
  - Large scale implementation of prehospital RSI for TBI
  - 209 pts matched with 627 historical non-intubated controls
  - “Prehospital RSI → increased odds of death.”
  - “Prehospital RSI → no effect on neuro outcome.”

- Wang, et. al., Ann Emerg Med 2004
  - Retrospective, statewide trauma registry
  - 4,098 TBI patients – compared OOH-ETI vs. ED-ETI
    - Excluded non-intubated cases
  - “OOH-ETI → 4x greater odds of death”
  - “OOH-ETI → 1.6x greater odds of poor neuro outcome”

Is Poor Outcome Due to Adverse Events and Errors?

- OOH-ETI is complex.
  - Strong potential for significant errors.

- Emerging evidence of unrecognized errors.
  - Clinical impact unknown.

“Why doesn’t OOH-ETI save lives?”

Katz and Falk (Annals of Emergency Medicine, January 2001)

- Prospective, observational study of 108 field intubations arriving at an urban ED.
  - “25% Misplaced”
    - 2/3 esophageal
    - 1/3 above vocal cords

- Themes echoed by similar studies.

Misplaced Tracheal Tubes by Paramedics in an Urban Emergency Medical Services System
Dunford, Ann Emerg Med 2004 (San Diego RSI Trial - Part 4)

- Subset of 152 RSI patients
- Out of 462 from total trial
- Continuously recorded waveforms:
  - Heart Rate
  - Oxygen Saturation
  - End-Tidal Capnography

Prehospital Airway Collaborative Evaluation (PACE I and PACE II)

- Prospective, multi-center observational trial.
- Over 40 Pennsylvania EMS services.
- Self-reported airway management data.
- Sample Size:
  - PACE I: n = 743 ETI
  - PACE II: n = 1,963 ETI


Dunford, et. al. (con’t)

- 31 (57%) of 54 patients experienced desaturation.
  - Median duration: 190 seconds (IQR 48 to 272)
  - Median desaturation (SpO2): 5%
- 6 (19%) patients experienced bradycardia
  - Pulse rate <50 beats/min.
- Paramedics described intubation as “easy” in 26 (84%) of 31 patients.

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“Does ETI Interact with Other Interventions?”
Intubation → Hyperventilation → BAD

Hyperventilation
- Known to be “bad” in TBI.
  - ↑ Vent → ↓ pCO2 → ↓ Cerebral Perfusion
- May be “bad” during CPR.
  - ↑ Vent → ↑ Intra-thoracic Pressure → ↓ Coronary Perfusion

“Does skill play a role?”

How Many Tubes Do You Need to Graduate?
- EM Residents 35
- Anesthesia Residents 20-57
- CRNA Students 200
- Paramedic Students 5

Wang, et al., Prehosp Emerg Care 2005

“Skill” (a.k.a. “proficiency”) = fn {Baseline Training + Regular Practice/Application}
Pearls for ED Airway Management

8/11/2005

H. Wang, MD

Per-Rescuer ETI Frequency for Pennsylvania Rescuers (2003)

- Median ETI: 1 (IQR: 0-3)
- 39% performed no ETI
- 67% performed 2 or fewer ETI

“Houston, We Have a Problem…”

- OOH-ETI is a (very) complex and difficult skill.
- Not proven to have clinical benefit.
- Prone to significant error (some unrecognized).
- Interacts with other interventions.
- Performed under worst possible conditions.
- Performed by rescuers with limited training.
  - Inadequate baseline training.
  - Inadequate clinical experience.

What Does this Mean for ED?

- We have no idea if ETI actually helps patients.
- We have no idea how popular ED airway management techniques affect physiology/outcome.
  - We do not know how RSI drug combinations work.
  - We do not know if RSI drug combinations are actually safe.
  - We do not know optimum sequence for ETI.
- We do not know the best ways to acquire or maintain airway management skills.

What Does this Mean for ED?

- “These bad EMS airway events probably also happen in the Emergency Department…”

Isn’t There a Lot of ED Airway Data?

- Limited descriptive series.
- Few RCT’s (n=1)
- Largest study (NEAR) not linked to patient outcomes.
- No studies of ED airway skill acquisition or maintenance.
  - One study of rescue airway skill retention by residents.

8 (Non-Evidence-Based) Pearls for ED Airway Management
8 Pearls for ED Airway Management

- 8. Respect Complexity
- 7. Prepare, Prepare, Prepare
- 6. Be Aware of Physiology
- 5. Prevention is the Best Way to Manage Airway Difficulty
- 4. Keep It Simple
- 3. Confirm, Confirm, Confirm
- 2. Always Have Back-Up Plan
- 1. Be Aware of Your Own Limits

No. 8 - Respect the Complexity of Airway Management

- Airway management is a complex process.
  - Little problems can rapidly add up to bad situation.
- Patient Safety Approach?
  - “Improve the System”
- Clinical Reality
  - Occurs under urgent or emergent conditions.
  - Process is inherently complex and high stress – simplification may not be possible/useful.

Think in Simple Terms

- Broad steps/decision points.
- Move quickly and decisively.
- Traynor’s Rule: Choose different equipment/technique/approach each time.
  - “Don’t repeat same thing over and over again.”
  - Realistically can change only 1-2 items each iteration.
- Think algorithmically.
- Think 2 steps ahead.

Airway Algorithm (An Example)

Wang, et. al., Prehosp Emerg Care 2005

Phrampus Model

Callaway Method

- “Curved blade.”
- “Straight blade.”
- “#11 blade.”
No. 7 – Prepare, Prepare, Prepare

- Equipment must be ready before you need it.
- Aviation-style checklist
  - Do not start down runway until checklist is verified.
  - Use the same level of meticulousness each time.

Dr. Phrampus’ Airway Checklist

- BVM and O2 On
- Suction On & Functioning
- Functional IV
- Pulse Ox & EKG Monitor
- Syringe
- Tube(s)
- Cuff Check
- Stylet
- Blade(s)
- Handle
- Light Confirmation Device
- Back – Up Plan

Patient Pre-Positioning is Crucial

- Position patient at your xiphoid.
- Don’t forget sniffing position.
  - Don’t use shoulder roll / hyperextension / stooping on ground.

No. 6 – Be Aware of Physiology

- Laryngoscopy is stressful on patient.
  - We do not fully understand this effect or implications.

- Use appropriate drugs.
- Use gentle technique.
- Get in quick, get out quick.
- Avoid multiple/prolonged laryngoscopies.
No. 5 - Prevention is Best Way to Manage Airway Difficulty

- Assume all ED intubations are difficult
- Recognize key anatomic traits
  - Obesity
  - Small mouth
  - Short neck
  - Large tongue
  - Over/underbite
  - Facial trauma
  - Physiologic crisis

- Anesthesia tools are not validated/useful in ED setting.
  - Throw out Mallampati, 3-2-2, thyromental distance...
  - Use as guidelines only.
  - Assume all ED airways are difficult.
- Remember to plan 2-3 steps ahead.
- If really difficult, think twice before pushing paralytic.

No. 4 – Keep It (Drugs) Simple

- Choose simple drug combinations.
  - Few agents
  - Simple dosing
  - Rapid acting
  - Short duration
- Assume all patients have:
  - Hypotension
  - Head injury

- Simple combination.
- Fits desired physiologic profile.
- Robust
  - Appropriate for many different clinical scenarios.

Etomidate 20 mg + Sux 140 mg

- Simple combination.
- Fits desired physiologic profile.
- Robust
  - Appropriate for many different clinical scenarios.

No Evidence to Support

- Lidocaine Pretreatment
- Defasciculation
- May be role for atropine in pediatric cases

- Paralyze judiciously
  - Carefully consider on a case-by-case basis.
- If paralytics contraindicated, consider deep sedation.
  - Etomidate 0.3 mg/kg = 20 mg
More Pearls . . .

- Avoid light sedation only
  - Versed, valium, morphine . . .
  - Slow, unpredictable onset
  - Long duration
  - Dangerous hemodynamic profile
  - Doesn’t work well at all...

No. 3 – Confirm, Confirm, Confirm

- No singular method is adequate.
  - Must use multiple techniques
  - Use multiple techniques when reconfirming EMS tubes.

- waveform capnography is current standard of ED care.
  - Most accurate (we think… still unproven in ED/EMS application)
  - Caution: can be misleading in cardiac arrest.

No. 2 – Always Have a Back-Up Plan

- “Never jump out of the plane without a reserve parachute.”

- Never say never.
  - Do not assume “can’t intubate, can’t ventilate” won’t happen.
  - 1 of every 1000 OR ETI “Difficult”
    - Probably higher for ED.
  - Do not assume the availability of anesthesia “back-up.”

No. 1 – Be Aware of Your Own Limits

- Quality of airway management highly dependent on skill.
- Seek opportunities to maintain and improve airway/ETI skills.
- Clinical situation may exceed your own airway management (ETI) skills.
  - Recognize quickly.
  - Move definitively to alternate methods.

Good Options

- Combitube
- LMA/ILMA
- Needle Jet Ventilation
- Cricothyroidotomy

Less Favorable Options

- Fiberoptic Intubation
- Bullard (or similar) devices
- Lighted Stylet
- Retrograde Intubation
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Disclaimer...

- “We didn’t say…”
  - “Paramedics can’t intubate.”
  - “Paramedics should stop intubating.”
- “We did say…”
  - “ETI is an incredibly complex skill.”
  - “There are some worrisome findings”
  - “These concerns apply to all persons who perform airway management – including Emergency Physicians.”

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Questions?