Errors in Paramedic Endotracheal Intubation

Henry E. Wang, MD, MPH
Assistant Professor
Department of Emergency Medicine
University of Pittsburgh School of Medicine
Disclosures

- AHRQ Clinical Scientist Development Award
  - K08 HS013628
- Laerdal Foundation
- Pittsburgh Emergency Medicine Foundation
Objectives

- Highlight results of AHRQ-funded effort to evaluate paramedic endotracheal intubation (ETI) errors.

- Highlight how studies of ETI errors have lead to broader questions regarding the structure, nature, and feasibility of paramedic care.
What is Endotracheal Intubation?

- Insertion of plastic breathing tube into trachea (windpipe).
- Believed to improve ventilation, oxygenation, protection from vomitus.
- Standard of US paramedic care for 25 years.
Controlled OR vs. Chaotic Field
Is Paramedic Endotracheal Intubation Effective? (Does it Reduce Mortality/Morbidity?)

- >14 studies of paramedic ETI and outcome (survival).

- Recurrent theme:
  - Paramedic ETI associated with *increased* risk of death.
  - Paramedic ETI associated with *poorer* neurological outcome.
Paramedic 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 rapid-sequence intubation (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.”
Paramedic ETI and Outcome - Highlights

  - Retrospective, statewide trauma registry
  - 4,098 TBI patients – compared OOH-ETI vs. ED-ETI
    - Excluded non-intubated cases
    - Multivariable and propensity score adjusted
  - “Paramedic ETI \( \rightarrow 4x \) greater odds of death”
  - “Paramedic ETI \( \rightarrow 1.6x \) greater odds of poor neuro outcome”
“How Can a Life-Saving Intervention Lead to Adverse Outcomes?”

“Is Poor Outcome Due to Adverse Events and Errors?”
Katz and Falk  
(Annals of Emergency Medicine, January 2001)

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

- Themes echoed by similar studies.
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 = 1,953 ETI

Acad Emerg Med 2003;10(7):717-24
Health Affairs 2006;25:501-509
Overall ETI Error Rate

- Tube Misplacement or Dislodgement: 3.1%
- ≥4 Attempts: 3.2%
- ETI Failure: 18.5%
- Any ETI Error: 22.7%

1 in 4.5 Exposed to an ETI Error
Per-Service ETI Error Rates

Exact 95% CI’s Excludes n<10 ETI

p=0.004
“Does skill play a role?”
How Many Intubations Do You Need to Graduate?

- Emergency Medicine Residents 35
- Anesthesia Residents 20-57
- CRNA Students 200
- Paramedic Students 5
Paramedic Student ETI “Learning Curve”


Magic Number: 15-20 ETI
Operating Room ETI Training

- Typical Emergency Medicine resident:
  - 160 OR hours
  - 50-100 ETI

- Typical Paramedic Student:
  - 17-32 hours
  - 6-10 ETI

“Skill” (a.k.a. “proficiency”)

= fn {Baseline Training
    + Regular Practice/Application}
Per-Rescuer ETI Frequency

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

The Barrier of Paramedic “Culture”

- Paramedic practice → “dogmatic.”
  - Reflects need to simplify thinking during chaos of field care.
- Side effects:
  - Narrow-minded thinking.
  - Unwillingness to accept new concepts, ideas or strategies.

- **Scientific data does not lead to change in practice.**
Summary
(“Weighing the Evidence”)

- 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.
- Training and experience are very limited.

“Aren’t these concerns applicable to all aspects of paramedic care???”
Ongoing/Future Efforts

- Relationship between Paramedic ETI Errors and Patient Outcomes
  - Probabilistic linkage of administrative data sets.
- Relationship between Paramedic ETI Experience and Patient Outcomes
- Characterization of Paramedic Workforce Culture
- Evaluation of Non-ETI Airway Methods
- Efforts to “Change Practice”
Contact

Henry E. Wang, MD, MPH
Assistant Professor
Department of Emergency Medicine
University of Pittsburgh School of Medicine
230 McKee Place, Suite 400
Pittsburgh, PA 15213
(412)-647-4925
wanghe@upmc.edu