DISCLOSURES

I have no financial interests to disclose
WHICH OF THE FOLLOWING IS TRUE?

A. The safety and efficacy of out of hospital RSI has been firmly established
B. Out of hospital ETI has been shown to improve outcomes in patients with TBI
C. The percentage of successful placement of SGAs is less than with endotracheal tubes
D. In many systems, paramedics on average perform few ETIs in the field
OBJECTIVES

- Review literature on safety and efficacy of prehospital ETI in the United States
- Review international literature regarding prehospital ETI
- Discuss safety and efficacy of alternatives to prehospital ETI
- Evaluate role of ETI in EMS
TRADITIONAL EMS TREATMENTS

- Endotracheal intubation
- Large fluid boluses to burn patients
- PASG
- Backboard “immobilization”
- C-collars in penetrating head injuries
- Lights and sirens
- Primary aggressive airway management in cardiac arrest
- Hyperventilation in head injury and cardiac arrest
NEMSIS ETI SUCCESS

- 16 US states
- 10,000 ETIs
- 2300 alternate airways
- 77% overall success rate to ETI
- Decreased success in the South

SUCCESS RATES

- 42 EMS services
- 1900 cases
- 1st attempt success 70% (sedation facilitated 48%)
- 2nd attempt success 85% (sedation facilitated 63%)
- 3rd attempt success 90% (sedation facilitated 75%)
- RSI ETI success:
  - 1st 56%
  - 2nd 81.3%
  - 3rd 91%

Wang et al. Acad Emer Med. 2006
ETI SUCCESS IN URBAN SYSTEM

- 1200 paramedics
- 926 Intubations
- Overall success 75%
- Cardiac arrest success 82%
- 5.2% malpositioned tubes
  - 9% in New York City study
  - Wirtz et al. Prehosp Em Care. 2007;11:213

ETI SUCCESS RATES

- MEDIC ONE study from Washington
- 4100 ETIs
- 97% success at 4 attempts
- 89% at 2 attempts
- Extensive initial training
- RSI available
- Recertification of <12 intubations/yr

OTTAWA ETI SUCCESS

- 1029 patients
- 64% success on 1st attempt
- 79% in two attempts
- 69.8% in trauma patients
- Non drug facilitated
- Performed if BVM not sufficient

DENMARK

- Survey of physicians staffing EMS
- 98% Anesthesiologists
- 17.6 years of experience, 7 in EMS
- 17.5% of workload in EMS
- 18.9% experienced “impossible intubation”
- 36% experienced difficult intubation

Rognas et al. Scan J Trauma, Resus, and Emer Med. 2010
SWITZERLAND

- Paramedic staffed ambulances
- Dispatched physicians perform all ETI
  - Anesthesiologists
- 3.2% incidence of difficult airway

UNITED KINGDOM

- Paramedics trained with 25 live intubations
- Averaged 7 per year subsequently
- Controlled OR theatre crossover ETI vs LMA
- LMA success 88.5% vs ETI 71%

FINLAND NON-CARDIAC ARREST

- ETI by physicians on HEMS
- Most common EMS impressions
  - Trauma with TBI
  - Intoxication
  - Suspected intracranial pathology
- 55% with good neurologic outcome
- 35% died, most within 30 days

Pakkanen et al. Acta Anesthes Scan. 2015
ETI VS SGA

- Meta-analysis
- 34,000 ETI and 41,000 SGA patients
- ETI showed better
  - ROSC
  - Survival to hospital admission
  - Neurologically intact survival

Benoit et al.  Resuscitation. 2015
MICHIGAN ETI IN CARDIAC ARREST

- 1414 cases
- Overall no difference in survival to hospital discharge
- In V-fib/V-tach
  - Decreased survival to hospital discharge in ETI patients

Egly et al. Prehospital Em Care. 2011
ETI IN CARDIAC ARREST

- Systematic review
- 303,000 patients
- No difference ETI vs SGA in survival
- No difference in favorable neurologic outcome
- Specifically sites Wang study

ETI VS SGA FROM ROC DATA

- Secondary analysis of ROC PRIMED trial
- 10,455 patients
- ETI associated with increased survival to discharge
- ETI associated with increased ROSC

AIRWAY IN CARDIAC ARREST

- CARES registry
- 13,000 cardiac arrests
- 80% with advanced airway
  - 2/3 ETI
  - 1/3 SGA (King most common)
- ETI with improved
  - ROSC
- Survival to discharge with good neuro function

McMullan et al. Resuscitation. 2014
KOREA

- Single tier system
- Limited personnel comparable to AEMT
  - ETI, LMA
- National CV disease database
- 5278 cardiac arrests
  - 87% with BVM; 5% ETI; 8% LMA
- Survival to admission and discharge BVM=ETI
- LMA showed decreased survival to discharge

JAPAN

- Established paramedics 1991
  - <1000 of training
  - Mostly Fire trained
- 2006: Could administer Epi without physician order
- System in some cities of providing doc on scene
- 3-4% of critical patients with >30min of communication to be accepted
  - Hori S. Keio J Med. 2010

JAPANESE CARDIAC ARREST

- Compared LM to ETI in cardiac arrest outcomes
  - 1 month favorable neurologic outcome
- 7500 witnessed non-traumatic arrests
- No difference in device used

Kajino et al. Critical Care. 2011
JAPANESE CARDIAC ARREST

- Compared LT to LM in OHCA
- System uses EOA or LM in cardiac arrest currently
- No significant differences in outcome
- No significant difference in successful ventilation
  - Both 75%

Yuichi et al. Amer J Emer Med. 2015
JAPAN CARDIAC ARREST STUDY

- 650,000 cases
  - 57% BVM
  - 6% ETI
  - 37% SGA
- Neurologically favorable outcome
  - Improved with BVM compared to advanced
  - ETI and SGA similar

Hasegawa et al. JAMA. 2013
TOKYO BVM VS ADVANCED AIRWAY

- 355 Patients
- 156 BVM
- 199 Advanced airway
  - Mostly LMA
- No difference
  - Prehospital ROSC
  - Hospital discharge with favorable neuro outcome

Anesthesiologist have prominent role in EMS
- Advanced airway performed by Anesthesiologist
  - Generally with some drug facilitation
  - Suggest considering waiting until hospital arrival
- Suggest first attempts with BVM
- Attempt SGA if BVM unsuccessful
  - LMA is preferred
- Prehospital personnel may attempt ETI in cardiac arrest

## i-gel

<table>
<thead>
<tr>
<th>Size</th>
<th>i-gel supraglottic airway for</th>
<th>Weight Range</th>
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<tbody>
<tr>
<td>1.0</td>
<td>neonates 2-5kg (5-11 lbs.)</td>
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</tr>
<tr>
<td>1.5</td>
<td>infants 5-12kg (11-25 lbs.)</td>
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<tr>
<td>2.0</td>
<td>small pediatrics 10-25kg (22-55 lbs.)</td>
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<tr>
<td>2.5</td>
<td>large pediatrics 25-35kg (55-77 lbs.)</td>
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<tr>
<td>3</td>
<td>small adults 30-60kg (65-130 lbs.)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>medium adults 50-90kg (110-200 lbs.)</td>
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</tr>
<tr>
<td>5</td>
<td>large adults 90+kg (200+lbs.)</td>
<td></td>
</tr>
<tr>
<td>Size</td>
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<td>2.5</td>
</tr>
<tr>
<td>------------</td>
<td>--------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Connector Color</td>
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<td>Orange</td>
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<tr>
<td>Cuff Pressure</td>
<td>60 cm H$_2$O</td>
<td>60 cm H$_2$O</td>
</tr>
<tr>
<td>Patient Criteria</td>
<td>35-45 inches (90-115 cm) or 12-25 kg</td>
<td>41-51 inches (105-130 cm) or 25-35 kg</td>
</tr>
<tr>
<td>KLTD O.D./I.D.</td>
<td>11 mm/7.5 mm</td>
<td>11 mm/7.5 mm</td>
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<tr>
<td>KLTD O.D./I.D.*</td>
<td>n/a</td>
<td>n/a</td>
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<tr>
<td>KLTD Cuff Volume</td>
<td>25-35 ml</td>
<td>30-40 ml</td>
</tr>
<tr>
<td>KLTD Cuff Volume</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>
# LMA Supreme™

**The Next Generation LMA™ Airway**

<table>
<thead>
<tr>
<th>Mask Size</th>
<th>Patient Size</th>
<th>Maximum Cuff Volume (Air)*</th>
<th>Largest size OG tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Neonates/infants up to 5 kg</td>
<td>5 ml</td>
<td>6 French</td>
</tr>
<tr>
<td>2</td>
<td>Infants 10-20 kg</td>
<td>12 ml</td>
<td>10 French</td>
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<tr>
<td>3</td>
<td>Children 30-50 kg</td>
<td>30 ml</td>
<td>14 French</td>
</tr>
<tr>
<td>4</td>
<td>Adults 50-70 kg</td>
<td>45 ml</td>
<td>14 French</td>
</tr>
<tr>
<td>5</td>
<td>Adults 70-100 kg</td>
<td>45 ml</td>
<td>14 French</td>
</tr>
</tbody>
</table>
ADVANCED ALTERNATE AIRWAYS

- Meta-analysis
- Pharyngeotracheal airway 82%
- Esophageal-tracheal combitube 85%
- LMA 87%
- King Lt 96.5%

Hubble et al. Prehosp Emer Care. 2010
ETI VS SGA IN IRAN

- Manikin study
- Success
  - 73% ETI
  - 98% LMA
  - 100% combitube
- Time to placement
  - ETI 19 sec
  - LMA 6 sec
  - Combitube 5 sec

FINLAND

- Looked at success rates with LMA
- Most ETI done with RSI by physicians in Finland
- Success rate of 100%
- Average time to place 10 seconds

Lankimaki et al. Scan J Traum, Resus, Emer Med, 2015
SGAs: ARE THEY PERFECT?

- Compression of carotid flow
- Increased aspiration
- Esophageal insufflation
NUMBERS FOR COMPETENCY

- 891 Students from 60 programs
- No ETIs reported by 89 students
- 556 students achieved 10 ETIs
- 175 students achieved 20 ETIs
- 71 students achieved >20 ETIs
- Each encounter increased success odds 1.067
- Success rate 78% to 96% over 30 ETIs

Wang et al. Prehospital Em Care. 2004
COMPETENCY

- Median number of intubations in training = 7
- Needed for 90% success rate = 20-25
- Washington study
  - Students attempted mean 29 ETIs
  - Overall success 88% (66% first pass)
  - Odds 1.097 greater with each successive patient

Warner et al. Prehosp Em Care. 2010
RURAL PRACTICE

- State EMS records
- 37-42% of providers annually performed ETI
- 1.4% performed pediatric ETI annually
- 1000 total ETIs per year
- 1300 eligible providers to perform ETI

Burton et al. Prehosp Em Care. 2003
FRANCE

- Two-tiered system
  - BLS Fire ambulance
  - Advanced life support units
- 105 regional SAMUs
- Physician dispatchers decide response and destination
- MICU critical care ambulances
  - Senior physician
  - Nurse
  - Response time <15min
- Many SAMU physicians are full time

Adnet et al. Resuscitation. 2004
ETI AND HEAD TRAUMA

- Netherlands study
- 231 patients
- Paramedics may intubate if GCS 3
- GCS 4-8 require physician intubation
- Survival rates similar in ETI and non-ETI in GCS<8

Franschman et al. Resuscitation. 2009
ETI IN HEAD INJURY FROM ROC

- Previous evidence of increased mortality with ETI
  - Bochicchio et al. J Trauma. 54(2):307
  - Davis et al. J Trauma. 2005
- 1600 patients with GCS <8
- ETI associated with increased mortality
- Sites with higher intubation attempt rates
  - Decreased overall mortality
  - Decreased mortality for those with ETI attempt

Davis et al. Prehosp Em Care. 2011
TIME ISSUES IN TRAUMA

- Mississippi state data base
- 192,000 trauma patients
- Added scene time for IV 5 min
- Added scene time for ETI 2:36

Carr, et al. Prehosp Em Care. 2008
OTHER TRAUMA ISSUES

- Hypoxia during intubation attempts
- Hyperventilation
  - Decreased cerebral circulation
  - Breath stacking
  - autopeep
COCHRANE REVIEW

- 2008
- Acutely ill and injured
- Concluded
  - Practice of prehospital ETI not well studied
  - Skill of operator is key
  - No evidence for trauma or pediatric ETI
  - Ethical and pertinent to perform high quality trial of ETI efficacy
NAEMSP STATEMENT ON RSI

- Need medical oversight concurrent and retrospective
- Initial training in procedure and patient selection
- Ongoing competence
- Training in alternate airways
- Appropriate training and equipment to confirm tube
- Standardized protocols
- Research to clarify the role in the EMS system

O'Conner. Prehosp Emer Care. 2005
PREHOSPITAL NIPPV

- Systemic review and meta-analysis
- 632 patients
- Patients treated with NIPPV
  - Reduction in hospital mortality
  - Need for invasive ventilation

SHOULD WE CONTINUE ETI

- Techniques
  - Drug facilitation
  - DSI
  - Apneic oxygenation
  - C-collar in penetrating head and neck injury
- Equipment
  - Videolaryngoscopy
DL vs VL

- King Vision VL
- Third service US EMS service
- 123 paramedics with RSI capability
- Average 2.9 intubations/year/paramedic
- Succinylcholine and Ketamine RSI
- Improved overall success with VL 91.5% v 64.9%
- Improved 1st pass success with VL 74.2% v 43.8%

Jarvis et al. Prehos Emer Care. 2015
RSI MEDICATIONS

- HEMS in UK with physician staffing
- 5 years of post-graduate training and 6 months anesthesia
- Using 3:2:1 induction
  - Fentanyl:Ketamine:Rocuronium
  - Improved laryngeal view
  - Improved first attempt success
  - Compared with Etomidate and suxamethonium

Lyon et al. Critical Care. 2015
2004 EDITION

MANUAL OF
Emergency Airway Management
SECOND EDITION

Ron M. Walls
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