Prehospital Pediatric Intubation Revisited

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Endotracheal Intubation (ETI)
Hot Issues

• Issues with Prehospital Endotracheal Intubation in Children
  – Complex procedure (60 steps? 25-40 + to gain mastery)
  – Skills not maintained over time
  – Potential for fatal consequences (>15% of ETT dislodged)
  – Laryngoscopy needed to remove FBs in the airway
  – ETT’s needed if tracheostomy dislodged?
  – Outcome not improved by incorporation of the skill in paramedic scope of practice
Survival:

- BMV 123/404 (30%)
- ET 110/416 (26%)
  ♦ OR=0.82 [0.61-1.11]
Neurologic outcome:

- 5 level neurologic outcome score
  - Good neurologic outcome = normal or mild disability
    - BVM  92/404 (23%)
    - ETI  85/416 (20%)
  ♦ OR= 0.87 [0.62-1.22]
Secondary analysis:

♦ Treatment received:
  ♦ survival - BVM (33%) vs ETI (14%), OR 0.32, 95% CI [0.20-0.50];
  ♦ neurologic outcome - BVM (26%) vs. ETI (8%), OR 0.26, 95% CI[0.15-0.45].
Results:

• Of 420 ETI patients:
• 305 attempted intubation (73%)
• 174 successful (57%) and 3 esophageal intubations
How many providers to maintain airway?

- BVM 134/165 (81%) with one provider
- ET 23/27 (85%) with one provider
ETI Complications (n=186):

<table>
<thead>
<tr>
<th>Complication</th>
<th>Count</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Tube size incorrect</td>
<td>44</td>
<td>24%</td>
</tr>
<tr>
<td>Main stem intubation</td>
<td>33</td>
<td>18%</td>
</tr>
<tr>
<td>Recognized dislodgement</td>
<td>15</td>
<td>8%</td>
</tr>
<tr>
<td>Unrecognized dislodgement</td>
<td>12</td>
<td>6%</td>
</tr>
<tr>
<td>Esophageal intubation</td>
<td>3</td>
<td>2%</td>
</tr>
</tbody>
</table>
Pulse oximetry on arrival in ED:

- Medians (IQR)
  - BVM 98% (93-100%)
  - ETI 97% (92-100%)

p value = 0.29
Gausche M, et al conclusions…

• Patient survival and neurologic outcome were not affected by intended airway management method
• For ETI, scene times are significantly longer and mortal complications are high
• EMS systems should question the use of ETI in the prehospital care of children
Prehospital Peds ETI

- Cooper A, et al (2001): Queried National Pediatric Trauma Registry for serious head injured patients – prehospital ETI offered No survival benefit or improved functional outcome compared to BMV
- Burton JH, et al (2003): Rural EMS providers rarely (1.4-2.7% of providers) attempt ETI; most providers <5 ETI attempts /yr
- Erhlich PF, et al (2004): 67% successful intubation rate; subsequent attempts resulted in more complications

- Evaluated populations at risk for non-attempt and failed attempts (adult and pediatric medical cardiac arrest and adult traumatic arrest)
- Retrospective observational study 2,669 oral ETI included adults and children

- Adults cardiac arrest:
  - 2,510 ETI 96% attempt rate and 14.7% failure rate
- Pediatric cardiac arrest:
  - 120 ETI ETI 71% attempt rate and 44.2% failure rate
  - RR 3.01 [95% CI 2.33-3.88] P<0.001
- Adult traumatic arrest
  - 257 ETI 67% attempt rate and 29.7% failure rate
  - RR 2.02 [95% CI 1.58-2.57] P<0.001

Jan 1997-July 2002 Kansas City Missouri

Relative risk compared to adult cardiac arrest
Prehospital ETI

• Denver Metro Airway Group (2009): Prospective data collection 4 months; > 800 patients; small number of children 48% with ETT in correct position
• Ruetzler K, et al (2011): “ETI associated with low success rate 78% dropped to 58% at 3 months since training.”
Cochrane Systematic Review

  - Reviewed 452 studies – only 3 RCTs (2 adults, 1 children)
  - None showed survival advantage for ETI
  - “In trauma and pediatric patients the current evidence base provides no imperative to extend the practice of prehospital intubation in urban systems”
AHA 2010: Prehospital ETI

• LOE 1 study randomized shows no difference in survival or neurological outcome
• Recommendation is that BMV recommended over ETI for ventilatory support in out-of-hospital setting
• Paramedic Self-efficacy and Skill Retention in Pediatric Airway Management
  – To determine the effect of pediatric airway management training on paramedic self-efficacy and skill performance and to determine which of several retraining methods is superior
Youngquist, et al…Skills Testing

- Pass rates for BMV and ETI were 66% (139/211) and 42% (88/212), respectively.
- Poor performance with ETI but not BMV was associated with time elapsed since training (p=0.01).

Paramedics retain the skill of BMV longer than ETI
### Self-Efficacy and Skill Performance

<table>
<thead>
<tr>
<th>Training</th>
<th>Self Efficacy</th>
<th>Skill Pass Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Training</td>
<td>moderate to very comfortable</td>
<td>BVM: 100% ET: 100%</td>
</tr>
<tr>
<td>Retraining</td>
<td>moderate to very comfortable</td>
<td>BVM: 66% ET: 42%</td>
</tr>
</tbody>
</table>

Self-efficacy ratings were not predictive of skill performance.

95% paramedics who failed both BMV and ETI skill testing after retraining reported confidence and lack of anxiety in ability to perform pediatric airway management.
Youngquist, et al…Conclusions

• There appears to be a gap between the level of self-efficacy and the ability of paramedics to perform pediatric airway management skills
  – If one uses the adult learning principle – “adults know when it is time to relearn skills”
  – Then skill retraining will be sought LONG after skill performance declines to unacceptable levels
Youngquist, et al...Conclusions

- Periodic, mandated/required airway management skill education and testing may be critical to quality pediatric patient care in the out-of-hospital setting.
  - This data suggests that retraining should occur at least every 6 months
Can paramedics get training in airway management on the job?

• Short answer…No

- Estimated - Take 20 years for each paramedic in 11 counties in California to perform BMV once on a child

Pediatric Continuing Education for Prehospital Providers: Is it Time to Mandate Review of Pediatric Knowledge and Skills?

Rate of procedural opportunity is not uniform

- Population of LA and Orange Counties, CA – 12-15 million persons; 25% children
- 830 patients over 2.75 years
- All got BMV
- 114 patients got ETI (14%)
- 2520 paramedics

12% of paramedics get experience in BMV per year; 1.6% of paramedics in ETI

- Survey of nationally registered EMS providers: Pediatric Education
  - Surveys completed by 18,218 EMS providers
  - represents 13% of all EMS providers
  - CE was the main source of pediatric education
  - Critical care infants are the greatest concern
Glaeser, et al:

• Less than 3% of EMS provider respondents care for greater than 15 pediatric patients (0-16 years) per month
• 0-3 pts/month
  – 60% EMT-P
  – 84% EMT-I
  – 87% EMT-B
• Only 12% of calls or about 1-2 calls/year resulted in the use of any advanced life support interventions
Glaeser, et al:

- 94% of the EMS provider respondents were more uncomfortable with infants and toddlers than any other age group
- Additional literature has shown a decrease in skill performance, success, and confidence in caring for this age group of patients
- Few opportunities for experience in caring for children

- Pediatric advanced life support care in an urban setting – 50 paramedics in the system
- Boston (pop 590,000) – over 1 year
  - 555 pediatric patients
  - Total Numbers of Procedures by Paramedics:
    - IV 184 (33%)
    - BMV 28 (5%)
    - ET 15 (3%)
    - IO 3 (0.5%)

**Number of procedures per medic:**

IV cannulation 3.7; BMV, 0.6; ETI 0.3; IO 0.06 per provider per year
Prospective study of EMS calls for children <16 years over a 6 month period in Ottawa, Canada

- 1377 Calls; Mean age 8.2 years
- Procedures performed:
  - Oxygen – 19.8%
  - Meds IV 1.4%
  - BVM 0.3%
  - ETI 0.1%
• The Future?
  – Workforce training and competencies
  – Creative methods to train and maintain skills for prehospital providers – need to be cost-effective
  – Simulation must play a role as experience unavailable – use of extraglottic devices (King/LT will become more frequent – no data in children on outcome)
  – Formal/controlled studies of airway techniques to include meaningful outcomes
Airway Management for Children

• What can we agree on?
  – Assessment for the need to support ventilation and oxygenation
  – Positioning (jaw thrust, towel roll, etc.)
  – Suctioning
  – Nasopharyngeal airway/Oropharyngeal airway
  – Bag-mask ventilation
  – FB management – laryngoscopy and use of pediatric Magill forceps
  – ETI limited use only… may be replaced with LMA/King???
Thank You!
References

References


• Richard J, Osmond MH, Nesbitt L, Stiell IG. Management and outcomes of pediatric patients transported by emergency medical services in a Canadian prehospital system. CJEM 2006;8:6-12.


