Prehospital Pediatric Intubation Revisited

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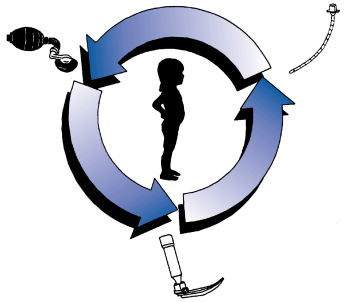
Endotracheal Intubation (ETI)

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

Pediatric Airway Management Project



- Gausche M, et al: Effect of out-of-hospital pediatric endotracheal intubation on survival and neurological outcome: A controlled clinical trial. *JAMA* 2000; 283:6:783-790.

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):

- Tube size incorrect 44 (24%)
- Main stem intubation 33 (18%)
- Recognized dislodgement 15 (8%)
- Unrecognized dislodgement 12 (6%)
- Esophageal intubation 3 (2%)

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

Garza AG, et al: *Prehosp Emerg Care* 2005

- 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

Garza AG, et al: *Prehosp Emerg Care* 2005

- 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

- Emergency intubation for acutely ill and injured patients Lecky F, et al: 2008
  - 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

Youngquist S, et al: *Acad Emerg Med*. 2008;15(12):1295-303

- 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

Training	Self Efficacy	Skill Pass Rate
Initial Training	moderate to very comfortable	BVM: 100% ET: 100%
Retraining	moderate to very comfortable	BVM: 66% ET: 42%

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

Gausche M, editorial, *Ann Emerg Med* 2000

- 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

Gausche M, et al: JAMA 2000

- 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

Glaeser, et al: Ann Emerg Med 2000

- 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

Babl, et al: *Pediatr Emerg Care* 2001

- 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

Richard J, et al: *CJEM* 2006

- 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

- Bernius M, et al: Prevention of drug dose calculation errors by prehospital care providers. *Prehosp Emerg Care* 2008;12:486-494.
- Babl FE, Vinci RJ, Bauchner H, Mottley L. Pediatric pre-hospital advanced life support care in an urban setting. Pediatr Emerg Care 2001;17(1):5-9.
- Deakin CD, Peters R, Tomlinson P, Cassidy M. Securing the prehospital airway: a comparison of laryngeal mask insertion and endotracheal intubation by UK paramedics. Emerg Med J 2005;22(1):64-7.
- Deakin CD, King P, Thompson F. Prehospital Advanced Airway Management by Ambulance Technicians and Paramedics: Is Clinical Practice Sufficient to Maintain Skills? Emergency Medicine Journal 2009;26:888-891.
- Garza AG, Algren DA, Gratton MC, Ma OJ. Populations at risk for intubation nonattempt and failure in the prehospital setting. Prehosp Emerg Care 2005;9:163-166.

References

•Gausche M, Lewis RJ, Stratton SJ, Haynes B, Gunter CS, Goodrich SM, Poore PD, McCollough MD, Henderson DP, Pratt FR, Seidel JSS: Effect of out-of-hospital pediatric endotracheal intubation on survival and neurological outcome: A controlled clinical trial. *JAMA* 2000;283:6:783-790.

•Hubble MW, Wilfong DA, Brown LH, Hertelendy A, Benner RW. A Meta-analysis of Prehospital Airway Control Techniques Part II: Alternative Airway Devices and Cricothyrotomy Success Rates. Prehospital Emergency Care 2010;14:515-530.

•Kuluz J. Improving Prehospital Airway Management and Care of Children with Severe Traumatic Brain Injury. Pediatric Critical Care Medicine 2011;12:112-113.

•Lammers RL, Byrwa MJ, Fales WD, Hale RA. Simulation-based assessment of paramedic pediatric resuscitation skills. *Prehosp Emerg Care*. 2009;13:345–56.

•Sanddal ND, Sanddal TL, Pullum JD, Altenhofen KB, Werner SM, Mayberry J, Rushton DB, Dawson DE. A randomized, prospective, multisite comparison of pediatric prehospital training methods. Pediatr Emerg Care 2004;20(2):94-100.

References

- Hubble MW, et al: A meta-analysis of prehospital airway control techniques part II: alternative airway devices and cricothyrotomy success rates. Prehosp Emerg Care 2010;14(4):515-30.
- 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.
- Sing RF, Reilly PM, Rotondo MF, Lynch MJ, McCans JP, Schwab CW. Out-of-hospital rapid-sequence induction for intubation of the pediatric patient. Acad Emerg Med 1996;3:41-45.
- Stratton SJ. Prehospital pediatric endotracheal intubation. Prehosp Disaster Med 2012;27:1-2. Epub 2012 Apr 25.
- Wang HE, Yealy DM. How Many Attempts Are Required to Accomplish Out-of-hospital Endotracheal Intubation? Acad Emerg Med 2006;13(4):372-7.
- Yardy N, Hancox D, Strang T. A comparison of two airway aids for emergency use by unskilled personnel: The Combitube and laryngeal mask. Anaesthesia 1999;54(2): 181-3.
- Youngquist S, Gausche-Hill M, Burbulys D. Alternative Airway Devices for Use in Children Requiring Prehospital Airway Management: Update and Case Discussion. *Pediatric Emergency Care* 2007;23:250-258.
- Youngquist S, Henderson DP, Gausche-Hill M, Goodrish SM, Poore PD. Paramedic Self-efficacy and Skill Retention in Pediatric Airway Management. *Academic Emergency Medicine* 2008,15:1295-1303. [Epub 2008 Oct 25].