PEDIATRIC PREHOSPITAL INTUBATION- TO DO OR NOT TO DO?

EMSAAC 2018 Research Panel

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DISCLAIMER

- Only 10 minutes ..... 

- ETI competency and retention NOT covered today

- Will cover
  - 20+ years of research
  - Key clinical scenarios
A WALK THROUGH THE LITERATURE
A WALK THROUGH THE LITERATURE: 80S

- **Milwaukee County** (Losek 1989)
  - 1 year retrospective study ETI in < 19 yo
  - 63 attempts
  - **78% success (49/63)**
    - 46% failure on <18 mo
    - 52% failure in non-cardiac arrest patients
  - Complications (25%):
    - ETT too small (4), accidental extubation (6), esophageal intubation (6)

- **Fresno County** (Aijan 1989)
  - 38 month retrospective study: <19 yo cardiac arrest patients
  - **63 patients, 28 attempts, 18 successful (64% success)**
    - 16 Patients <1 yo: 6 attempts (38%), 3 successful (50%)
  - Complications
    - Major (unrecognized esoph ETI, removing correct ETI): 7%
    - Minor (wrong tube, trauma, mainstem, vomiting): 39%
  - **18 intubated patients**
    - 8 died in ED, 9 survive to admission, **1 survived to discharge**
A WALK THROUGH THE LITERATURE: 90S

**Georgia** (Boswell 1995)
- 6 year retrospective study comparing peds (<15 yo) to adult ETI in patients with GCS <9 brought to TC by HEMS

**Adult:**
- 353 adults, 84% attempted, **90.2% success rate**
- 9.8% unsuccessful

**Pediatrics:**
- 63 patients, 92% attempted, **66% success rate**
- 34% unsuccessful
- 25 non-ETI ped pts
  - 20 unsuccessful attempts, 14 were TBI, **11 NOT intubated in ED**

**King County** (Brownstein 1995)
- 7 yr retrospective review of 355 successfully intubated <16 yo
- 654 intubated, 355 (54%) study patients

**Complications (22.6%)**
- 39% incorrect ET size
- Incorrect placement: *mainstem 34 (12.6%), esophageal 5 (1.8%)*
- Serious complications **10.7%**
- **56 extubated in ED (58% with seizure diagnosis)**
A WALK THROUGH THE LITERATURE

- **Los Angeles and Orange County** (Gausche-Hill 2000)
  - 3 year randomized control trial
  - 830 patients <13 yo BVM vs ETI
  - 57.7% success
  - **Complications: (57.4%)**
    - 3 esophageal intubations, 12 (6%) unrecognized dislodgements: 14/15 of these **died**
    - 15 (8%) recognized dislodged tube
    - 33 (18%) mainstem
    - 44 (24%) wrong ETT size
  - **No sig. diff in survival (30% BVM vs 26% ETI)**
  - **No sig. diff in neurological outcome (23% BVM vs 20% ETI)**

- **San Diego County** (Vilke 2002)
  - 4.5 year retrospective review
  - 1158 acute patients < 15 yo
  - 324 attempted intubations, **82% Success**
  - 3 esophageal (did not look for other complications)
A WALK THROUGH THE LITERATURE

- **West Virginia rural trauma patients** (Ehrlich 2004)
  - 10 year retrospective review
  - 105 (<19yo):
    - 57% in field (F), 22% referring hospital (RH), 21% at trauma center (TC)
  - First attempt success: **67% F, 69% RH, 95% TC**
  - ETI failure rates: **50% F, 0% RH, 0% TC**
  - Airway complications: **66% F, 29% RH, 4% TC**
  - Only 9.3% could not be oxygenated or ventilated with BVM prior to ETI

- **National Pediatric Trauma Registry** (DiRusso 2005)
  - 8 year database review
  - 50,199 patients: 5,460 (11.6%) intubated
    - 1,930 in field (F), 1,654 in referring hospital (RH), 1,876 trauma center (TC)
    - Mortality rates for intubated patients: **F 38.5%, RH 16.7%, TC 13.2%**
  - Field intubation is an independent strong negative predictor of survival or good functional outcome despite adjustment for severity of injury
Mortality with field ETI of trauma patient is higher regardless of NISS and head injury and survival to DC home is lower.

Fig. 3. Comparison of actual (observed) death rate versus expected death rates by intubation status or place of intubation. Non, patients not intubated; Field, patients intubated in the field; NTC, patients intubated in a non–trauma center hospital; TC, patients intubated at a trauma center; NS, no statistically significant difference between actual and expected.

A WALK THROUGH THE LITERATURE

- **King County** (Prekker 2016)
  - 6 year retrospective study
  - 299 ETI in < 13 yo
  - 66% 1st pass attempt, 97% overall success
  - **Complication rate: 25%**
    - 1 iatrogenic tracheal injury, 6 peri-intubation arrests
    - 12 bradycardia
    - 5 recognized esophageal intubations
    - 16 recognized tube dislodgments; 3 unrecognized
    - 47 mainstem
  - 26 extubated in ED and 2 failed never needed ETI in ED
A WALK THROUGH THE LITERATURE

- **Resuscitation Outcomes Consortium cardiac arrest database** (Tijssen 2015)
  - 7 year retrospective database review
  - 2,244 OHCA (3d-19yo)
  - Improved survival: Shorter scene times, IV/IO attempts, IVF administration
  - **Advanced airways not associated with survival**

- **Cardiac Arrest Registry (CARES) database** (Hansen 2017)
  - 3 year retrospective database review
  - 17 states, 55 cities
  - 1724 < 18 non-traumatic cardiac arrest
    - EMS service who had BMV, ETI, and SGA options
    - 781 (45.3%) BVM; 727 (42.2%) ETI, and 215 (12.5%) SGA
    - 20.7% ROSC, 10.9% hospital discharge
  - **BVM associated with higher survival to hospital discharge compared to ETI and SGA**
    - Odds ratio survival to discharge
      - ETI vs BMV 0.39 (95%CI 0.26-0.59)
      - SGA vs BMV 0.32 (95%CI 0.12-0.84)
ONE LAST PAPER

- “Get with the Guidelines-Resuscitation registration” (Anderson 2016)
  - 14 year observational study from the <18 yo IN-HOSPITAL cardiac arrest patients
    - 2,294 total cardiac arrest cases, 1555 (68%) intubated
  - Survival was lower in ETI group (36% vs 41%, RR 0.89 95%CI 0.81-0.99)
  - ETI during in hospital pediatric cardiac arrest was associated with decreased survival to hospital discharge

<table>
<thead>
<tr>
<th>Survival</th>
<th>Not Intubated</th>
<th>Intubated</th>
<th>Risk Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unadjusted analysis</td>
<td>495/739 (67)</td>
<td>667/1555 (43)</td>
<td>0.64 (0.59-0.69)</td>
</tr>
<tr>
<td>Main adjusted analysis</td>
<td>460/1135 (41)</td>
<td>411/1135 (36)</td>
<td>0.89 (0.81-0.99)</td>
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<tr>
<td>Sensitivity analyses</td>
<td></td>
<td></td>
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<tr>
<td>Imputation of missing data</td>
<td>580/1376 (42)</td>
<td>513/1376 (37)</td>
<td>0.88 (0.79-0.99)</td>
</tr>
<tr>
<td>Excluding patients who received CPB</td>
<td>426/1058 (40)</td>
<td>382/1058 (36)</td>
<td>0.90 (0.81-0.99)</td>
</tr>
<tr>
<td>Excluding patients who received &lt;2 min of chest compressions</td>
<td>343/881 (39)</td>
<td>307/881 (35)</td>
<td>0.90 (0.80-1.00)</td>
</tr>
<tr>
<td>Subgroup analyses</td>
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<tr>
<td>Patients who were pulseless at any time</td>
<td>288/853 (34)</td>
<td>254/853 (30)</td>
<td>0.88 (0.77-1.01)</td>
</tr>
<tr>
<td>Patients with pulse present at initiation of CPR</td>
<td>193/325 (59)</td>
<td>166/325 (51)</td>
<td>0.86 (0.75-0.98)</td>
</tr>
</tbody>
</table>

| ROSC                                   |               |           |                    |
| Unadjusted analysis                    | 636/739 (86)  | 1130/1555 (73) | 0.84 (0.81-0.88)   |
| Main adjusted analysis                  | 771/1135 (58) | 770/1135 (68) | 1.00 (0.95-1.06)   |
| Sensitivity analyses                   |               |           |                    |
| Imputation of missing data             | 952/1376 (69) | 944/1376 (69) | 0.99 (0.93-1.05)   |
| Excluding patients who received CPB    | 690/1058 (55) | 698/1058 (66) | 1.01 (0.95-1.08)   |
| Excluding patients who received <2 min of chest compressions | 590/881 (67) | 592/881 (67) | 1.00 (0.94-1.07)   |
| Subgroup analyses                      |               |           |                    |
| Patients who were pulseless at any time | 530/853 (62) | 518/853 (61) | 0.98 (0.91-1.05)   |
| Patients with pulse present at initiation of CPR | 281/325 (86) | 282/325 (87) | 1.00 (0.95-1.06)   |

| Favorable neurologic outcome            |               |           |                    |
| Unadjusted analysis                    | 244/563 (43)  | 313/1318 (24) | 0.55 (0.48-0.63)   |
| Main adjusted analysis                  | 211/983 (21)  | 185/987 (19) | 0.87 (0.75-1.02)   |
| Sensitivity analyses                   |               |           |                    |
| Imputation of missing data             | 351/1376 (26) | 298/1376 (22) | 0.85 (0.73-0.98)   |
| Excluding patients who received CPB    | 178/899 (20)  | 173/923 (19) | 0.95 (0.82-1.09)   |
| Excluding patients who received <2 min of chest compressions | 154/762 (20) | 139/769 (18) | 0.89 (0.73-1.10)   |
| Subgroup analyses                      |               |           |                    |
| Patients who were pulseless at any time | 132/758 (17) | 111/768 (14) | 0.83 (0.68-1.02)   |
| Patients with pulse present at initiation of CPR | 107/254 (42) | 79/260 (30) | 0.72 (0.58-0.90)   |
WAIT A SECOND... LET’S TAKE A SECOND LOOK AT THAT LITERATURE
CARDIAC ARREST

- **Prehospital**
  - Advanced airways not associated with survival (Tijssen)
  - BVM associated with higher survival to hospital discharge compared to ETI and SGA (Hansen)

- **In hospital**
  - ETI during in hospital pediatric cardiac arrest compared with no ETI was associated with decreased survival to hospital discharge (Andersen)
TRAUMA

- “Airway protocols clearly need to emphasize BVM in children until transfer to trauma center, especially if provider adequately establishes oxygenation and ventilation” (Ehrlich)

- “Field intubation is an independent strong negative predictor of survival or good functional outcome despite adjustment for severity of injury” (DiRusso)
Throughout literature, numerous cases ended up not requiring ETI in ED, were extubated on arrival, and/or were discharged home.

- Pediatric status epilepticus
  - Allow patient to receive anti-epileptic(s) first

- Are there prehospital ETI occurring that do not deserve the risk of ETI?
WHAT HAPPENS IF YOU REMOVE CARDIAC ARREST, TRAUMA, AND SEIZURES AS INDICATIONS FOR PEDIATRIC PREHOSPITAL ETI?

- 1989 Losek: 63 --> 6 in 1 year
- 1995 Brownstein: 355 --> ~154 over 7 years
- 2000 Gausche-Hill: 415 (ETI group)--> 28 over 3 years
- 2002 Vilke: 264 --> 44 in 4.5 years
- 2004 Ehrlich: 105 --> 20 in 10 years
- 2016 Prekker: 299 ETT --> 50 over 6 years

- Roughly 10 pediatric ETI/Year in a system
**PEDIATRIC ETI CONCLUSIONS**

- Lower success rates in children, especially infants
- Low frequency
- High complication rates
- May decrease survival and neuro outcome in cardiac arrest and trauma
- Unnecessary ETIs occurring prehospital?

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**Do the risks outweigh the benefits?**
- Should we focus on the basics… oxygenation, ventilation and perfusion?
THANK YOU
REFERENCES


REFERENCES CONTINUED


