Pediatric Resuscitation is No Small Matter

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Disclosures

- No financial interests
- Lara Rappaport
  - Involved in many of the studies
- I don’t like Peter
Pediatric Myths

- Pain management is bad
Myth

• Epinephrine should be feared
  – It should not!
  • Anaphylaxis
  • Asthma
    – Remember the IM is better than SQ!
Myth

• Kids don’t have blood pressures
  – They do!
Myth

• Children are not little adults
  – They are!
Adults Are Just Big Kids
Kids ARE Small Adults

- History and physical exam are key
- ABCs
- Develop a relationship with your patient
  - It will be worth your time
- Fear doesn’t work
Dispelling the Myths

• “Kids can’t come back from cardiac arrest”
  – Significant improvements in
    • Out of hospital cardiac arrest survival in adults
    • In-hospital cardiac arrest survival in kids
### Perspective

**Pediatric Cardiac Arrest Statistics**

<table>
<thead>
<tr>
<th>In Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved</td>
</tr>
<tr>
<td>1980 - 9%</td>
</tr>
<tr>
<td>2000 - 17%</td>
</tr>
<tr>
<td>2006 - 27%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Out of Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unchanged in 20 years</td>
</tr>
<tr>
<td>Infants 3%</td>
</tr>
<tr>
<td>Children &amp; Adolescents 9%</td>
</tr>
</tbody>
</table>
• Bystander CPR rates remain low in kids
  – Sasson et al
    • Circulation, 2013
• Bystander CPR makes a difference
  – Naim et al
    • JAMA Peds, 2017
Clinical paper

Time on the scene and interventions are associated with improved survival in pediatric out-of-hospital cardiac arrest

Janice A. Tijssen, David K. Prince, Laurie J. Morrison, Dianne L. Atkins

25-30 Minutes On Scene

Highest Survival to Discharge
2015 AHA/ECC Guidelines

• Update from 2010

• Pre-arrest
  – Fluids for septic shock
    • At least 20 cc/kg
  – No atropine for intubation
Pediatric Cardiac Arrest

- Intra-arrest:
  - ETCO$_2$ to evaluate CPR

- Poor predictors of OHCA
  - Nonshockable rhythm

- Prolonged duration of arrest
  - Without CPR
Pediatric Cardiac Arrest

• No demonstrated effectiveness of vasopressors
  – Epinephrine is reasonable
Pediatric Cardiac Arrests

- Amiodarone or lidocaine for refractory VF/VT
Post-Cardiac Arrest

- Hypothermia (32 to 34 degrees) may be reasonable
- Normoxemia, rather than hyperoxemia, is the likely goal
## ACLS and PALS

### Adult Algorithm
- Epinephrine
- Electricity + Epi + Amio
- Electricity + Epi + Amio
- Adenosine
- Benzodiazepine
- Dextrose
- Epi 1:1000 IM + H2 + Steroid
- Beta agonist + Steroid + Mag

### Etiology
- Asystole / PEA
- Ventricular Fibrillation
- Pulseless V-Tach
- SVT
- Seizure
- Hypoglycemia
- Anaphylaxis
- Asthma

### Pediatric Algorithm
- Epinephrine
- Electricity + Epi + Amio
- Electricity + Epi + Amio
- Adenosine
- Benzodiazepine
- Dextrose
- Epi 1:1000 IM + H2 + Steroid
- Beta agonist + Steroid + Mag
National Prehospital Guidelines for Pediatric Seizure and Traumatic Pain Management Do Not Concur with Information on the Broselow-Luten Length Based Tape

Kathleen Adelgais, Karl Marzc, Toni Gross, Lara Rappaport. 2015

Background: The Ambulance Equipment List includes the pediatric length/weight-based tape. The Broselow-Luten Pediatric Emergency Tape (Broselow LBT) has assessment tools, equipment selection, and medication doses. Recent prehospital evidence-based guidelines (EBG) provide pediatric-specific recommendations for seizure and traumatic pain management. The purpose of this study was to examine the ability of the Broselow LBT to facilitate care per these two EBGs. We hypothesized that the Broselow LBT can correctly facilitate only a few EBG recommendations.

Methods: A critical review of the pediatric seizure and traumatic pain EBGs identified specific recommendations related to assessment tools, equipment size, and medication dose. Four study investigators examined the Broselow LBT (2011, Edition A) using a standardized scoring sheet to classify each recommendation: “CAN be followed” (stratified by correct and incorrect information), and “CAN NOT be followed” (no information listed). To validate the scoring process, investigators utilized a modified Delphi method with a target for consensus of >80%. The primary outcome was the number of recommendations for which Broselow LBT provided correct information to facilitate management.

Results: Pediatric seizure and traumatic pain EBGs contained 8 and 11 relevant recommendations, respectively. Target consensus for classifying recommendations was achieved after 2 iterations. The Broselow LBT provided correct information for 3 recommendations on the seizure guideline (dextrose and lorazepam dose, size of IV/IO catheters). The Broselow LBT stated dose for midazolam was 3 times that recommended on the EBG. For 3 non-panural doses of midazolam (first-line EBG treatment recommendation), no information was available. For the traumatic pain EBG, only 1 recommendation (size of BP cuff to assess for hypotension) could be correctly followed per the Broselow LBT. Broselow LBT listed incorrect information for 3 recommendations, end-tidal CO2 equipment and fentanyl dose editions: the only dose of IV fentanyl being 3-fold that recommended for pain management. Most recommendations (7/11), could not be followed, including doses of intranasal fentanyl and morphine, assessment of pain score, Glasgow Coma Scale, and pulse-oximetry equipment.

Conclusion: Few prehospital EBG recommendations can be accurately followed by information on the Broselow LBT. Additional tools to facilitate pediatric care according to prehospital EBG recommendations may be necessary.
# Handtevy System

## Denver Paramedics

<table>
<thead>
<tr>
<th>Drug</th>
<th>Concentration</th>
<th>Volume</th>
<th>Route</th>
<th>Dose/KG</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenosine (1st)</td>
<td>12 mg/4 mL</td>
<td>0.67 mL</td>
<td>IV/IO</td>
<td>0.1 mg/kg</td>
<td>2 mg</td>
</tr>
<tr>
<td>Adenosine (2nd)</td>
<td>12 mg/4 mL</td>
<td>1.3 mL</td>
<td>IV/IO</td>
<td>0.2 mg/kg</td>
<td>4 mg</td>
</tr>
<tr>
<td>Albuterol</td>
<td>2.5 mg/3 mL</td>
<td>6 mL</td>
<td>NEB</td>
<td>Dose =</td>
<td>5 mg</td>
</tr>
<tr>
<td>Amlodipine</td>
<td>150 mg/3 mL</td>
<td>2 mL</td>
<td>IV/IO</td>
<td>5 mg/kg</td>
<td>100 mg</td>
</tr>
<tr>
<td>Atropine</td>
<td>1 mg/10 mL</td>
<td>4 mL</td>
<td>IV/IO</td>
<td>0.02 mg/kg</td>
<td>0.4 mg</td>
</tr>
<tr>
<td>Atrovent</td>
<td>0.5 mg/2.5 mL</td>
<td>2.5 mL</td>
<td>NEB</td>
<td>Dose =</td>
<td>0.5 mg</td>
</tr>
<tr>
<td>Bicarb 8.4%</td>
<td>50 mEq/50 mL</td>
<td>20 mL</td>
<td>IV/IO</td>
<td>1 mEq/kg</td>
<td>20 mEq</td>
</tr>
<tr>
<td>Calcium Gluconate</td>
<td>1 g/10 mL</td>
<td>10 mL</td>
<td>IV/IO</td>
<td>Dose =</td>
<td>1 g</td>
</tr>
<tr>
<td>D5W (D5W - 35 mL) + 25 mL NS</td>
<td>40 mL</td>
<td>IV/IO</td>
<td>0.5 g/kg</td>
<td>10 g</td>
<td></td>
</tr>
<tr>
<td>Diazepam</td>
<td>10 mg/2 mL</td>
<td>0.8 mL</td>
<td>IV/IO</td>
<td>0.2 mg/kg</td>
<td>4 mg</td>
</tr>
<tr>
<td>Diphenhydramine</td>
<td>60 mg/mL</td>
<td>0.4 mL</td>
<td>IV/IO</td>
<td>1 mg/kg</td>
<td>20 mg</td>
</tr>
<tr>
<td>Epipen 1:1000 IM</td>
<td>1 mg/ml</td>
<td>0.2 mL</td>
<td>IM</td>
<td>Dose =</td>
<td>0.2 mg</td>
</tr>
<tr>
<td>Epipen 1:10,000 IV</td>
<td>1 mg/10 mL</td>
<td>2 mL</td>
<td>IV/IO</td>
<td>0.01 mg/kg</td>
<td>0.2 mg</td>
</tr>
<tr>
<td>Epipen IV Anaphylaxis</td>
<td>1:100,000</td>
<td>10 mL</td>
<td>IV</td>
<td>Dose =</td>
<td>0.1 mg</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>100 mcg/2 mL</td>
<td>0.4 mL</td>
<td>IV/IO</td>
<td>1 mcg/kg</td>
<td>20 mcg</td>
</tr>
<tr>
<td>Fentanyl Intrasaiol</td>
<td>100 mcg/2 mL</td>
<td>0.5 mL</td>
<td>IM</td>
<td>Dose =</td>
<td>1 mcg/kg</td>
</tr>
<tr>
<td>Glucagon</td>
<td>1 mg/mL</td>
<td>1 mL</td>
<td>IM</td>
<td>Dose =</td>
<td>1 mg</td>
</tr>
<tr>
<td>Methypridinelolone</td>
<td>125 mcg/2 mL</td>
<td>0.84 mL</td>
<td>IV</td>
<td>2 mg/kg</td>
<td>40 mg</td>
</tr>
<tr>
<td>Midazolam 5%</td>
<td>5 mg/mL</td>
<td>0.8 mL</td>
<td>IM/IN</td>
<td>0.2 mg/kg</td>
<td>4 mg</td>
</tr>
<tr>
<td>Midazolam IV</td>
<td>5 mg/mL</td>
<td>0.4 mL</td>
<td>IV/IO</td>
<td>0.1 mg/kg</td>
<td>2 mg</td>
</tr>
<tr>
<td>Morphine</td>
<td>4 mg/mL</td>
<td>0.5 mL</td>
<td>IM/IM</td>
<td>0.5 mg/kg</td>
<td>2 mg</td>
</tr>
<tr>
<td>Naloxone</td>
<td>2 mg/2 mL</td>
<td>0.5 mL</td>
<td>IV/IO</td>
<td>Dose =</td>
<td>0.5 mg</td>
</tr>
<tr>
<td>Normal Saline Bolus</td>
<td>0.9%</td>
<td>400 mL</td>
<td>IV/IO</td>
<td>20 mL/kg</td>
<td>400 mL</td>
</tr>
<tr>
<td>Ondansetron IV</td>
<td>2 mg/mL</td>
<td>0.5 mL</td>
<td>IM</td>
<td>Dose =</td>
<td>4 mg</td>
</tr>
<tr>
<td>Ondansetron ODT</td>
<td>4 mg/tablet</td>
<td>1 tab</td>
<td>PO</td>
<td>Dose =</td>
<td>4 mg</td>
</tr>
<tr>
<td>Racemic EPI</td>
<td>Add 2 mL NS</td>
<td>0.5 mL</td>
<td>NEB</td>
<td>Dose =</td>
<td>0.5 mL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lifepak</th>
<th>Joules/Kg</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defibrillation</td>
<td>2, 4, 6, 8</td>
<td>50</td>
<td>70</td>
<td>125</td>
<td>150</td>
</tr>
<tr>
<td>Cardiopulmonary</td>
<td>0.5, 1, 2, 2</td>
<td>10</td>
<td>20</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

## ET Tube

<table>
<thead>
<tr>
<th>ET Tube</th>
<th>Distance at LIP</th>
<th>King</th>
<th>EPI-O</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5 (U) Stylet 10</td>
<td>16.5 cm</td>
<td>2.5</td>
<td>25 mm</td>
</tr>
</tbody>
</table>

## Vitals

<table>
<thead>
<tr>
<th>Vitals</th>
<th>SBP</th>
<th>HR</th>
<th>RR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>80 - 115</td>
<td>70 - 116</td>
<td>20 - 24</td>
</tr>
</tbody>
</table>
Results

• Since implementation
  – 85% greater likelihood of getting pain medication
  – 50% greater likelihood of getting treatment for seizures and anaphylaxis
  – Increased scene time
    • 100% CPR
    • 100% Epi
Take Home

• Kids are little adults
• It is a paradigm shift
  – But a good one
• Pediatric resuscitation should look more like adult resuscitation
• Result has been
  – More pain/seizure/anaphylaxis meds
  – Longer scene times
  – Much more enthusiasm
E-mail

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