Adrenaline Rush
Does sooner mean better?

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Disclosure

Vidacare ® Corporation provided support for a portion of this study to include administrative support and supplies. Additionally, they have provided permission to utilize some of the graphics shown in this presentation.
Issues

• Epinephrine has not demonstrated a decrease in mortality
• Previous studies do not measure time to epinephrine delivery
• Historically epinephrine delivery is delayed until after IV establishment
Resuscitation Goals

• Restore Circulation
• Deliver more perfusing/hypothermic patients to the ED
• Discharge home neurologically intact patients

Concern

• Epinephrine increases occurrences of ROSC
• Epinephrine does not increase improved neurologic outcomes
Hypotheses

1. Reducing the delay to epinephrine delivery will increase the rate of ROSC

2. Improved rates of ROSC in conjunction with Therapeutic Hypothermia will improve neurological outcomes.
• Setting –
  – City of San Antonio – 7th largest US city
  – Dual Paramedic System (Fire based)
  – Fire First Responders--Mixed ALS (40%)/BLS (60%)
  – Typical Cardiac Arrest Response:
    • 2 Medic Units, 1 Fire Crew (4),
    • Medical Officer

Training –
  • Uninterrupted Compressions
  • Humeral IO insertion
  • Rapid Epi Delivery (Goal – 90 seconds after arrival)
  • Delayed Advanced Airway Management
  • Post ROSC Hypothermia
Training

• Classroom (1.5 hrs)
  – Didactic and Hands on Humeral access
  – Previously trained on IO
• Cadaver lab dependent upon availability
• Specific SAFD Cardiac Arrest Management Video
• Continuous Feedback
  – Immediate mandatory post incident consultation with online medical control
Protocol

Adult Cardiac Arrest – V-fib / V-tach

- Defibrillate – 200 J biphasic (or shock with AED if no defibrillator available)
- Resume CPR immediately – do not stop CPR to check rhythm for 2 minutes
- Humeral IO - (Tibial IO or IV if unable to obtain humeral IO after 2 attempts)
  - Epinephrine (1:10,000) 1 mg IO/IV
    - Give within 90 seconds of determination of V-fib or V-tach, but after defibrillation
  - Intubate with endotracheal tube (ETT) or King Tube (KT) – re-check ETCO2
  - NS 250 – 500 cc IO/IV bolus (unless obvious pulmonary edema noted in ETT/KT)
  - Amiodarone 300 mg IO/IV
  - Blood glucose as soon as possible

- Rhythm check after 2 minutes of CPR
  - (AED if no monitor/defibrillator)

- Continue CPR while defibrillator is charging
- Defibrillate – 200 J biphasic (check with AED if no defibrillator available)
- Resume CPR immediately for 2 minutes uninterrupted
  - DO NOT delay CPR to check rhythm after shock!
  - Epinephrine (1:10,000) 1 mg IO/IV
  - Amiodarone 150 mg IO/IV
  - **Consider possible causes of cardiac arrest and additional treatments (see page V.9)**

- Rhythm check after 2 minutes of CPR
  - (AED if no monitor/defibrillator)

- Call Medical Director to discuss possible field termination if patient meets criteria
  - (see “Termination of Resuscitation” section)

- If patient does not meet “Termination of Resuscitation” criteria, lead and transport after third round of drugs given (3 epinephrine and 3 atropine if applicable)
- If patient has Return of Spontaneous Circulation (ROSC) go to Post-resuscitation Care / Hypothermia Protocol and transport

Adult Cardiac Arrest – PEA / Asystole

- Resume CPR immediately – Do not stop CPR to check rhythm for 2 minutes
- Humeral IO - (Tibial IO or IV if unable to obtain humeral IO after 2 attempts)
- Epinephrine (1:10,000) 1 mg IO/IV
  - Give within 90 seconds of determination of PEA / Asystole
  - Atropine 1 mg IO/IV if Asystole or PEA with rate <60
  - Intubate with endotracheal tube (ETT) or King Tube (KT)
  - NS 250 – 500 cc IO/IV bolus (unless obvious pulmonary edema noted in ETT/KT)
  - Blood glucose as soon as possible
  - **Consider causes of cardiac arrest and appropriate treatments (See page V.9)**

- Rhythm check after 2 minutes of CPR
  - (AED if no monitor/defibrillator)

- Call Medical Director to discuss possible field termination if patient meets criteria
  - (see “Termination of Resuscitation” section)

- If patient does not meet “Termination of Resuscitation” criteria, lead and transport after third round of drugs given (third epinephrine and atropine if applicable)
- If patient has Return of Spontaneous Circulation (ROSC) go to Post-resuscitation Care / Hypothermia Protocol and transport
Results

851 Resuscitation Attempts
305 patients with ROSC
60 VFib patients with full data set
**ABSTRACT**

**Background.** Intraosseous (IO) needle insertion is often utilized in the adult population for critical resuscitation purposes. Standard insertion sites include the proximal humerus and proximal tibia, for which limited comparison data are available. **Objective.** This study compared the frequencies of IO first-attempt success between humeral and tibial sites in out-of-hospital cardiac arrest. Methods. This observational study was conducted in an urban setting between August 28, 2009, and October 31, 2009, and included all medical car-diac arrest patients for whom resuscitative efforts were performed. Cardiac arrest protocols stipulate that paramedics insert an IO line for initial vascular access. During the first month of the study, the proximal humerus was the preferred primary insertion site, whereas the tibia was preferred throughout the second month. The primary outcome was first-attempt success, defined as secure IO needle position in the marrow cavity and normal fluid flow. Any needle dislodgment during resuscitation was also recorded. The association between first-attempt IO success and initial IO insertion location was analyzed using a test of independent proportions and 95% confidence intervals (CIs) for the difference in proportions. **Results.** There were 88 cardiac arrest patients receiving IO placement, with 58 (65.9%) patients receiving their initial IO attempt in the tibia. The rate of first-time IO success at the tibia was significantly higher than that observed at the humerus (89.7% vs. 60.0%; p < 0.01). There were 18 initial successes at the humerus; for six (33.3%) of these, the needle became dislodged during resuscitation, compared with 52 initial successes at the tibia, with three (5.8%) dislodgments. The rate of total success for initial IO placements was significantly lower for the humerus (40.0%) compared with that for the tibia (84.5%; p < 0.01) during resuscitation efforts. **Conclusions.** In this subset of patients, tibial IO needle placement appeared to be a more effective insertion site than the proximal humerus. Success rates were higher with a lower incidence of needle dislodgments. Further randomized studies are required in order to validate these results. **Key words:** intraosseous infusion; emergency medical services; sudden cardiac death; needle insertion sites
Humeral IO Insertion

94% Successful after 2\textsuperscript{nd} attempt
n= 232

91% Successful 1\textsuperscript{st} attempt
n= 224

6% not successful after 2\textsuperscript{nd} attempt
n= 15

<1% Obesity

<1% Secure Placement but no flow

<4% Other or not documented

2% Dislodgement

405 cardiac arrests evaluated. average age of 63 (+/-16), 58% male, Humeral access attempted in 61% (n=247)
Minutes to Epinephrine versus ROSC in the V-fib/V-Tach Patient

<table>
<thead>
<tr>
<th>ROSC, N (%)</th>
<th>&gt; 2</th>
<th>≤ 2</th>
<th>Total</th>
<th>Relative Risk (95% CI)</th>
<th>P-value</th>
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<tbody>
<tr>
<td>No</td>
<td>21 (50)</td>
<td>8 (44.4)</td>
<td>29 (48.3)</td>
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<td>.78</td>
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<td>21 (50)</td>
<td>10 (55.6)</td>
<td>31 (51.7)</td>
<td>0.9 (0.54, 1.5)</td>
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<td>Total</td>
<td>37</td>
<td>18</td>
<td>60</td>
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Greater than 2 minutes compared to less than 2 minutes

• Improvement from 50% to 55% of patients have ROSC
Minutes to Epinephrine versus ROSC in the V-fib/V-Tach patient

<table>
<thead>
<tr>
<th>ROSC, N (%)</th>
<th>Minutes to Epinephrine</th>
<th>Total</th>
<th>Relative Risk (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
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<tr>
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<td>29 (48.3)</td>
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<td>13 (44.8)</td>
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<tr>
<td>Yes</td>
<td>&gt; 3</td>
<td>15 (48.4)</td>
<td>30 (51.7)</td>
<td>0.88 (0.54, 1.43)</td>
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<td></td>
<td>≤ 3</td>
<td>16 (55.2)</td>
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<tr>
<td>Total</td>
<td></td>
<td>26</td>
<td>29</td>
<td>60</td>
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</table>
Greater than 3 minutes compared to less than 3 minutes

• Improvement from 48% to 55% of patients have ROSC
Limitations

• Numbers of patients meeting study goal are limited
• No other rhythm demonstrated improvement
• Documentation of time intervals subject to variation
### Dead versus ROSC (Before 07/01/2009)

<table>
<thead>
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<th>Dead, N (%)</th>
<th>ROSC</th>
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</thead>
<tbody>
<tr>
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<td>No</td>
<td>Yes</td>
<td>Total</td>
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<td>P-value²</td>
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<tr>
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<td>51 (14.6)</td>
<td>51 (5.5)</td>
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<tr>
<td>Yes</td>
<td>580 (100)</td>
<td>298 (85.4)</td>
<td>878 (94.5)</td>
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<tr>
<td>Total</td>
<td>580</td>
<td>349</td>
<td>929</td>
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### Dead versus ROSC (After 07/01/2009)

<table>
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<th>Dead, N (%)</th>
<th>ROSC</th>
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</thead>
<tbody>
<tr>
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<td>No</td>
<td>Yes</td>
<td>Total</td>
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<td>P-value²</td>
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<tr>
<td>No</td>
<td>0 (0)</td>
<td>54 (17.7)</td>
<td>54 (6.3)</td>
<td>&lt;0.001</td>
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<tr>
<td>Yes</td>
<td>546 (100)</td>
<td>251 (82.3)</td>
<td>797 (93.7)</td>
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</tr>
<tr>
<td>Total</td>
<td>546</td>
<td>305</td>
<td>851</td>
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Current issues

• ~ 50% Epinephrine within the 90 second goal
  – Protocol compliance
    • Trying to identify the obstacles
    • Difficult to automate time documentation
  
– Training all EMT-B’s in use of Humeral EZIO for adult cardiac arrest
Acknowledgements

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• Men and Women of the San Antonio Fire Department

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• Vidacare Inc.
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Questions?