Effects of Intra-Resuscitation Antiarrhythmic Administration on Rearrest Occurrence and Intra-Resuscitation ECG Characteristics in the ROC ALPS Trial

Disclosures

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ROC Funding Partners

- National Heart, Lung and Blood Institute
- Institute of Circulatory and Respiratory Health of the Canadian Institute of Health Research
- Defence Research and Development Canada
- United States Army
- Heart and Stroke Foundation of Canada
- American Heart Association
Intra-Resuscitation Antiarrythmics

- Stabilize the myocardium
- Prevent rearrest downstream of a shock
- Avoid additional time in VF
- Avoid need for additional shocks
Intra-Resuscitation Antiarrhythmic

VF → Not VF → VF

Recurrent VF / Rearrest
Prehospital Rearrest

• Loss of pulses after ROSC

• Rearrest includes all ECG rhythm presentations of cardiac arrest

• Relatively common (44% in ROC-CCC)

• Strongly associated with poor survival and neurologic outcomes, regardless of rhythm
Intra-Resuscitation Antiarrythmics

• Impact myocardial electrophysiology. Could they….
  • Alter the defibrillation threshold?
  • Change the probability of successful defibrillation?
  • Adversely effect other resuscitation outcomes?
• No difference in Survival / Neurologic outcomes
• Higher rates of Survival to Admission
Why?

I don’t know, but...

Let’s return to our premises.
Premises

• Did A/L/P prevent rearrest?
  • Look for rearrest after ROSC & antiarrhythmic administration

• Did A/L/P alter probability of defibrillation success?
  • Investigate waveform properties of the ECG before defibrillation but after antiarrhythmic administration
Quantitative Waveform Measures

Visually Different

Quantifiably Different
Hypotheses

• H1: Rearrest rates will differ between amiodarone, lidocaine and placebo groups

• H2: Quantifiable features of the ECG will differ between the amiodarone, lidocaine and placebo groups and by rearrest status
Study Design

- Retrospective analysis of the ROC ALPS Trial

- Consider only patients who achieved prehospital ROSC after initial administration of A, L or P

- Cases with ROSC prior to randomization would have had a rearrest in order to be randomized
The Resuscitation Outcomes Consortium
Case Data

- Same dataset compiled for the primary trial (2012-2015)

- EMS-treated out-of-cardiac arrest (OHCA) cases with data abstracted from:
  - Prehospital patient care reports – Demography / Condition / Treatment/Status
  - Defibrillator downloads – CPR Process / ECG / Shock Delivery
  - Hospital records – Patient / Treatment / Outcomes
Rearrest

• Indicated by site-level data abstractors in the patient record

• Any loss of pulses after ROSC

• Time-coded with respect to the treatment record

• Verified by direct signal analysis by the investigative team
Quantitative Waveform Measures

• Centrally uploaded defibrillator download files were extracted and imported into UPitt’s SPAIN OHCA analysis platform

• 3-second ECG segments were parsed corresponding to:
  • First analyzable VF
  • Immediate pre-ROSC VF
  • VF at the onset of rearrest

• Amplitude spectrum area (AMSA), median slope (MS), and centroid frequency (CF) were calculated for each segment
Analysis

• Rearrest rates were compared between A/L/P groups with multivariable logistic regression, adjusting for common patient, condition and treatment variables, as well as ROC site.

• Quantitative waveform measures were compared across A/L/P groups and rearrest status with 2-Way ANOVA, or…

• Between A/L/P groups with 1-Way ANOVA for VF at the onset of rearrest

• Separately considered the association between rearrest and survival
Cohort

ALPS Trial

2,381

ROSC*

1,144 (48%)

1,237 (52%)

Rearrest

503 (44%)

641 (56%)

ECG Available

424 (37%)

No ROSC

No Rearrest
Survival and Neurologic Function by Rearrest Status

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th>95% CI</th>
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<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No Rearrest</strong></td>
<td>Ref.</td>
<td>Ref.</td>
<td>Ref.</td>
<td>Ref.</td>
</tr>
<tr>
<td><strong>Rearrest</strong></td>
<td>0.55</td>
<td>(0.39, 0.77)</td>
<td>0.69</td>
<td>(0.48, 0.97)</td>
</tr>
</tbody>
</table>

Adjusted Estimates

**ROSC at Emergency Dept. Arrival**

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th>95% CI</th>
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<tr>
<td><strong>Rearrest</strong></td>
<td>0.24</td>
<td>(0.18, 0.31)</td>
<td>0.30</td>
<td>(0.22, 0.40)</td>
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**Prehospital ROSC**

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Rearrest Rates Across A/L/P Groups

Adjusted Estimates

<table>
<thead>
<tr>
<th>Treatment Arm</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placebo</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>1.13</td>
<td>(0.85, 1.52)</td>
</tr>
<tr>
<td>Amiodarone</td>
<td>1.01</td>
<td>(0.75, 1.37)</td>
</tr>
</tbody>
</table>
Quantitative Waveform Measures Across A/L/P Groups Stratified by Rearrest Status (Pre-ROSC)

Differences

By Rearrest
AMSA & MS
(p=0.028, p=0.020)

By A/L/P
MS & CF
(p=0.024, p=0.45)
Interpretation

• This is a complicated, incomplete picture of an even more complicated problem.

• Primary study’s A/L/P associations with survival to arrival / admission would imply a connection to rearrest. However, rearrest is reversible…

• Tendency of placebo to have higher Quantitative Waveform Measures suggests an effect, but the clinical significance of the effect is unclear.

• Lower Quantitative Waveform Measures among rearrest VF suggests a pre-ROSC predictive tool, but one entangled with shock prediction.
Limitations

• Rearrest is more mechanistically broad than recurrent VF

• Rearrest was only ascertained in cases with ROSC after drug.

• We only considered first ROSC / first rearrest.

• ECG analyses only covered a proportion of cases.
Conclusions

• Prehospital rearrest was not associated with amiodarone, lidocaine or placebo administration in the ROC ALPS trial.

• Quantifiable features of the VF ECG waveform differed by rearrest case status and A/L/P group.
Thank You.
Funding Partners
Co-Authors
Mentors
Leo