THE NEW GUIDELINES TO COME: NEW EVIDENCE AND ITS IMPLICATIONS IN ACLS

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Contents

- Ilcor SEERS (scientific evidence evaluation & review system)
- Monitoring physiological parameters of high quality CPR
- Vasopressors for cardiac arrest
- Defibrillation strategies for VF or VT
- Mechanical CPR devices
1. Ilcor.org (http://www.ilcor.org/home/)
PICO question list

ILCOR Scientific Evidence Evaluation and Review System

C2015 was a Success!
The world's resuscitation experts were in Dallas, Texas from January 31 to February 5, 2015 to discuss the latest research and draft recommendations on cardiopulmonary resuscitation (CPR) and emergency cardiovascular care (ECC). Over 200 attendees representing member councils of the International Liaison Committee on Resuscitation (ILCOR) helped in finalizing systematic evidence evaluations during the 2015 International Consensus Conference on CPR and ECC Science, in preparation for the Consensus on Science with Treatment Recommendations (CoSTR), scheduled for online publication in the medical journals Circulation and Resuscitation on October 15, 2015. ILCOR's councils, including the American Heart Association and the European Resuscitation Council, will simultaneously publish CPR and ECC guidelines based in part on CoSTR.

ILCOR’s seven task forces--Acute Coronary Syndrome (ACS); Advanced Life Support (ALS); Basic Life Support (BLS); Education, Implementation and Teams (EIT); First Aid; Neonatal Resuscitation (NRP); and Pediatric Life Support (Peds)--were hard at work to gather consensus on the science and recommendations around a number of clinical and education questions.

Thank you to everyone who provided feedback on over 150 questions and reviews (listed below). ILCOR encouraged all stakeholders to participate in a successful public comment period that ran until February 28, 2015.

ILCOR Reviews (Public Comment period closed on Feb. 28)

**ACS**
- Computer assisted STEMI ECG interpretation
- Direct transport to PCI centre vs PH Lysis
- Fibrinolysis and immediate PCI for STEMI
- Fibrinolitics vs delayed PCI for STEMI by time intervals
- Non-physician STEMI ECG interpretation
- PCI after ROSC with ST-elevation
- PCI after ROSC without ST-elevation
2. Monitoring physiological parameters of high quality CPR
Adult Cardiac Arrest

Shout for Help/Activate Emergency Response

Start CPR
- Give oxygen
- Attach monitor/defibrillator

2 minutes
Return of Spontaneous Circulation (ROSC)

Check Rhythm
- If VF/VT Shock

Post-Cardiac Arrest Care

Drug Therapy
- IV/IO access
  - Epinephrine every 3-5 minutes
  - Amiodarone for refractory VF/VT

Consider Advanced Airway
- Quantitative waveform capnography

Treat Reversible Causes

Continuous CPR

Monitor CPR Quality

CPR Quality
- Push hard (>2 inches [5 cm]) and fast (>100/min) and allow complete chest recoil
- Minimize interruptions in compressions
- Avoid excessive ventilation
- Rotate compressor every 2 minutes
- If no advanced airway, 30:2 compression-ventilation ratio

- Quantitative waveform capnography
  - If PETCO₂ <10 mm Hg, attempt to improve CPR quality
  - Intra-arterial pressure
  - If relaxation phase (diastolic) pressure <20 mm Hg, attempt to improve CPR quality

Return of Spontaneous Circulation (ROSC)
- Pulse and blood pressure
- Abrupt sustained increase in PETCO₂ (typically ≥40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Shock Energy
- Biphasic: Manufacturer recommendation (120-200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered.
- Monophasic: 360 J

Drug Therapy
- Epinephrine IV/IO Dose: 1 mg every 3-5 minutes
- Vasopressin IV/IO Dose: 40 units can replace first or second dose of epinephrine

- Amiodarone IV/IO Dose: First dose: 300 mg bolus. Second dose: 150 mg.

Advanced Airway
- Supraglottic advanced airway or endotracheal intubation
- Waveform capnography to confirm and monitor ET tube placement
- 8-10 breaths per minute with continuous chest compressions

Reversible Causes
- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypo-/hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary

Case 1 Monitor CPR quality

CVP catheter in RA

CVP catheter in femoral artery
Case 1 Monitor CPR quality
Coronary Perfusion Pressure

Aortic pressure: 94/39 (54), RA: 80/20, CPP: 19 mmHg, ETCO$_2$: 18 mmHg

CPP = (Aorta – RA) in diastolic phase
2. Monitoring physiological parameters of high quality CPR

- Recommendation
  - No treatment recommendation for any particular physiological parameters measure to guide CPR such as ETCO$_2$, coronary perfusion pressure, aortic pressure
  - Useful for guide to high quality CPR
3. Vasopressors for cardiac arrest
Adult Cardiac Arrest

Shout for Help/Activate Emergency Response

1. Start CPR
   - Give oxygen
   - Attach monitor/defibrillator

2. Rhythm shockable?
   - VF/VT
     - Shock
   - CPR 2 min
     - IV/IO access

3. Rhythm shockable?
   - Yes
     - Shock
   - No
     - CPR 2 min
       - Epinephrine every 3-5 min
       - Consider advanced airway, capnography

6. Rhythm shockable?
   - Yes
     - Shock
   - No
     - CPR 2 min
       - Epinephrine every 3-5 min
       - Consider advanced airway, capnography

CPR Quality
- Push hard (≥2 inches [≥5 cm]) and fast (≥100/min) and allow complete chest recoil
- Minimize interruptions in compressions
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Advanced Airway
- Supraglottic advanced airway or endotracheal intubation
# Single dose EP vs vasopressin

Makoyama 2009

<table>
<thead>
<tr>
<th>Outcome</th>
<th>SDE</th>
<th>Vasopressin</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Events</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROSC</td>
<td>42</td>
<td>51</td>
<td>1.1 (0.7, 1.8)</td>
</tr>
<tr>
<td>Survival to admission</td>
<td>32</td>
<td>30</td>
<td>0.8 (0.5, 1.4)</td>
</tr>
<tr>
<td>Survived to DC</td>
<td>6</td>
<td>10</td>
<td>1.1 (0.5, 4.2)</td>
</tr>
<tr>
<td>Survival with CPC 1 or 2</td>
<td>0</td>
<td>4</td>
<td>0.6 (0.5, 1.4)</td>
</tr>
</tbody>
</table>

Total: SDE 158, Vasopressin 178

(Worksheet authors: Laurie MORRISON and Clifton CALLAWAY and Steve LIN)
ROSC rate between epinephrine vs. vasopressin/epinephrine combination on patient outcomes

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Vaso/Epi Events</th>
<th>Vaso/Epi Total</th>
<th>Epi Events</th>
<th>Epi Total</th>
<th>Weight</th>
<th>Risk Ratio M-H, Random, 95% CI</th>
<th>Risk Ratio M-H, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ducros 2011</td>
<td>0</td>
<td>14</td>
<td>2</td>
<td>16</td>
<td>1.5%</td>
<td>0.23 [0.01, 4.36]</td>
<td></td>
</tr>
<tr>
<td>Gueugniaud 2008</td>
<td>24</td>
<td>1442</td>
<td>33</td>
<td>1452</td>
<td>30.2%</td>
<td>0.73 [0.44, 1.23]</td>
<td></td>
</tr>
<tr>
<td>Lindner 1997</td>
<td>8</td>
<td>20</td>
<td>3</td>
<td>20</td>
<td>8.6%</td>
<td>2.67 [0.82, 8.62]</td>
<td></td>
</tr>
<tr>
<td>Ong 2012</td>
<td>11</td>
<td>374</td>
<td>8</td>
<td>353</td>
<td>13.6%</td>
<td>1.30 [0.53, 3.19]</td>
<td></td>
</tr>
<tr>
<td>Wenzel 2004</td>
<td>57</td>
<td>589</td>
<td>58</td>
<td>597</td>
<td>46.2%</td>
<td>1.00 [0.70, 1.41]</td>
<td></td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>2439</strong></td>
<td><strong>2438</strong></td>
<td><strong>100.0%</strong></td>
<td></td>
<td><strong>1.00</strong> [0.70, 1.44]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total events: 100
Heterogeneity: $\tau^2 = 0.04$; $\chi^2 = 5.33$, df = 4 ($P = 0.26$); $I^2 = 25$
Test for overall effect: $Z = 0.01$ ($P = 0.99$)

(Worksheet authors: Laurie MORRISON and Clifton CALLAWAY and Steve LIN)
Survival to discharge rate between epinephrine vs. vasopressin/epinephrine

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Vaso/Epi Events</th>
<th>Total</th>
<th>Epi Events</th>
<th>Total</th>
<th>Weight</th>
<th>Risk Ratio M-H, Random, 95% CI</th>
<th>Risk Ratio M-H, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Callaway 2006</td>
<td>52</td>
<td>167</td>
<td>48</td>
<td>158</td>
<td>5.2%</td>
<td>1.02 [0.74, 1.42]</td>
<td></td>
</tr>
<tr>
<td>Ducros 2011</td>
<td>6</td>
<td>14</td>
<td>8</td>
<td>16</td>
<td>0.9%</td>
<td>0.86 [0.39, 1.87]</td>
<td></td>
</tr>
<tr>
<td>Gueugniaud 2008</td>
<td>413</td>
<td>1442</td>
<td>428</td>
<td>1452</td>
<td>43.1%</td>
<td>0.97 [0.87, 1.09]</td>
<td></td>
</tr>
<tr>
<td>Lindner 1997</td>
<td>16</td>
<td>20</td>
<td>11</td>
<td>20</td>
<td>2.7%</td>
<td>1.45 [0.92, 2.29]</td>
<td></td>
</tr>
<tr>
<td>Ong 2012</td>
<td>119</td>
<td>374</td>
<td>106</td>
<td>353</td>
<td>11.8%</td>
<td>1.06 [0.85, 1.32]</td>
<td></td>
</tr>
<tr>
<td>Wenzel 2004</td>
<td>282</td>
<td>589</td>
<td>260</td>
<td>597</td>
<td>36.2%</td>
<td>1.10 [0.97, 1.24]</td>
<td></td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>2606</strong></td>
<td><strong>2596</strong></td>
<td><strong>100.0%</strong></td>
<td></td>
<td></td>
<td><strong>1.04 [0.96, 1.12]</strong></td>
<td></td>
</tr>
</tbody>
</table>

Total events: 888  | 861

Heterogeneity: Tau² = 0.00; Chi² = 4.58, df = 5 (P = 0.47); I² = 0%

Test for overall effect: Z = 1.02 (P = 0.31)

(Worksheet authors: Laurie MORRISON and Clifton CALLAWAY and Steve LIN)
3. Vasopressors for cardiac arrest

- Treatment Recommendation: We suggest against initiating vasopressin as a substitution for epinephrine in the treatment in cardiac arrest. (weak recommendation, low quality)
- Values and Preferences Statement: The recommendation considers the fact that vasopressin is widely used now, and the available data do not indicate any reason to change practice.

(Worksheet authors: Laurie MORRISON and Clifton CALLAWAY and Steve LIN)
4. Defibrillation strategies for VF or VT

- **Recommendation (2010)**
  - biphasic waveform are more effective for defibrillation than monophasic ones
  - Biphasic energy level: 120 - 200 J
  - Monophasic energy level: 360 J
Fig. 2. A, Forest plot of the summary effect estimates of termination of ventricular fibrillation after first shock between biphasic and monophasic waveforms in patients experiencing out-of-hospital cardiac arrest. W (random), weights in random-effects DerSi...

(Chih-Hung Wang, Biphasic versus monophasic defibrillation in out of hospital cardiac arrest a systematic review and meta-analysis, The American Journal of Emergency Medicine, 2013)
Fig. 4. A, Forest plot of the summary effect estimates of return of spontaneous circulation between biphasic and monophasic waveforms in patients experiencing out-of-hospital cardiac arrest. W (random), weights in random-effects DerSimonian–Laird model. B, F...

(Chih-Hung Wang, Biphasic versus monophasic defibrillation in out of hospital cardiac arrest a systematic review and meta-analysis, The American Journal of Emergency Medicine, 2013)
Fig. 5. Forest plot of the summary effect estimates of survival to hospital discharge between biphasic and monophasic waveforms in patients experiencing out-of-hospital cardiac arrest. W (fixed), weights in fixed-effect Mantel-Haenszel model.

(Chih-Hung Wang, Biphasic versus monophasic defibrillation in out of hospital cardiac arrest a systematic review and meta-analysis, The American Journal of Emergency Medicine, 2013)
4. Defibrillation strategies for VF or VT

- Recommendation
  - Biphasic waveform is used for both atrial and ventricular arrhythmias in preference to a monophasic waveform monophasic defibrillator
  - First shock is not successful and the defibrillator is capable of delivering shocks of higher energy it is reasonable to increase the energy for subsequent shocks
4. Mechanical CPR devices
5. Mechanical CPR Device

Figure 1: The AutoPulse™ portable board has a size of \( \sim 100 \text{ cm} \times 60 \text{ cm} \) and contains a motor to retract the broad load-distributing band (lifeband) under microprocessor control.
5. Mechanical CPR devices

- Treatment Recommendation:
- We suggest mechanical chest compression devices should not be considered the standard of care for cardiac arrest patients, but can be considered a reasonable alternative to high quality manual chest compressions in some settings (weak recommendation, moderate quality of evidence).
Conclusion

CPR quality

Vasoactive agents

Defibrillation strategy

Mechanical CPR device

Adaptation
Thank you for your attention!!

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