Interactive with ACLS!

Reviewing the Basics and a 2015 Update

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April 22, 2016
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Objectives

• Describe the pharmacist’s role in code response

• Review pharmacotherapy treatment options in ACLS

• Summarize key changes in the 2015 AHA Guidelines for CPR and ECC

• Review key pharmacologic components of crash carts
Pharmacist Role in Code Response

• Lower mortality when part of CPR teams

• Roles
  – Medication dosing
  – Medication procurement & preparation
  – Critical thinking

TERMS

• ROSC – Return of Spontaneous Circulation

• OHCA – Outside Hospital Cardiac Arrest

• VT/VF – Ventricular Tachycardia/Ventricular Fibrillation

• CPR – Cardiopulmonary Resuscitation
ACLS Cardiac Arrest Algorithm.

“Evolutionary, not revolutionary”

**Ref: Adult Cardiac Arrest Algorithm—2015 Update.**

Mark S. Link et al. Circulation. 2015;132:S444-S464

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Patient Case

• Tragedy strikes
  – A pharmacy resident, functioning on caffeine, anxiety, and stress starts to feel “funny”
  
  – Walks from his office to the ED...

I don’t feel so good...
“A turn for the worse”

• Suddenly Dan becomes unresponsive….
• A quick look to the monitor shows:

CODE BLUE!!!
The Code

• What should the team do now?
  A. One round (30:2) of CPR
  B. Defibrillate at 200 J for biphasic shock
  C. Give 1 dose of Epinephrine 1mg IV
SHOCK HIM!!!

• 2015 re-emphasis: Shock first if AED immediately available and shockable rhythm analyzed, otherwise start CPR first

• Rationale: Survival benefit from defibrillation is time dependent

“Evolutionary, not revolutionary”
Chest Compression Rate

• 2010: “It is reasonable for lay rescuers and HCPs to perform chest compressions at a rate of at least 100 beats/min”

• 2015: “In adult victims or cardiac arrest, it is reasonable for rescuers to perform chest compressions at a rate of 100 – 120 beats/min”

Chest Compression Rate

- 10,371 patients with OHCA

- ROSC in 34% patients – 9% survived until hospital discharge

<table>
<thead>
<tr>
<th>Rate Categories (compressions/min)</th>
<th>ROSC</th>
<th>Survival to Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>p</td>
</tr>
<tr>
<td>&lt;80 (n=335)</td>
<td>0.97 (0.74–1.27)</td>
<td>0.811</td>
</tr>
<tr>
<td>80-99 (n=1,933)</td>
<td>0.99 (0.86–1.13)</td>
<td>0.841</td>
</tr>
<tr>
<td>100-119 (n=2,932)</td>
<td>Reference group</td>
<td></td>
</tr>
<tr>
<td>120-139 (n=955)</td>
<td>0.98 (0.82–1.16)</td>
<td>0.781</td>
</tr>
<tr>
<td>&gt;140 (n=244)</td>
<td>1.08 (0.79–1.47)</td>
<td>0.640</td>
</tr>
</tbody>
</table>

Adjusted model (including compression depth and fraction) n=6,399

Chest Compression Rate

- Reduction in quality chest compressions
  - Proportion of compressions <1.5in (38mm)
    - 100 – 119 beats/min: 35%
    - 120 – 139 beats/min: 50%
    - >140 beats/min: 70%

Chest Compression Depth

• 2010: “The adult sternum should be depressed at least 2 inches”

• 2015: “During manual CPR, rescuers should perform chest compressions to a depth of at least 2 inches (5cm) for an average adult, while avoiding excessive chest compression depths (>2.4in)”

Chest Compression Depth

- 9,136 patients with OHCA

Maximum survival was in the depth interval of 40.3 – 55.3mm

Chest Compression Depth

• 170 adult resuscitated patients
  – Recorded compression quality; compared to chest CT or Xray during post-resuscitation care
  – 32% (n=54 had sustained injuries)
    • Mainly rib and sternal fractures
  – Compression Depth (% injured)
    • <50mm – 28%
    • 50-60mm – 27%
    • >60mm – 49%

THE CODE CONTINUES
“Evolutionary, not revolutionary”
Adult Cardiac Arrest: Vasopressors

- 2010: “One dose of vasopressin 40 units IV/ IO may replace either the first or second dose of epinephrine in the treatment of cardiac arrest”

- 2015: “Vasopressin in combination with epinephrine offers no advantage as a substitute for standard-dose epinephrine in cardiac arrest”

Vasopressin versus epinephrine
Mukoyama, et al.

Patients with out of hospital cardiac arrest

Prospective randomized control (Tokyo, Japan)
Epinephrine 1mg q5-10mins (max 4mg) n=158
Vasopressin 40 IU q5-10 mins (max: 160 IU) n=178

Primary End Point: survival to hospital discharge; ROSC; 24-h survival

Mukoyama, et al. study

- Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Vasopressin</th>
<th>Epinephrine</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROSC</td>
<td>51 (28%)</td>
<td>42 (26.6%)</td>
<td>0.762</td>
</tr>
<tr>
<td>24-h survival</td>
<td>30 (16.9%)</td>
<td>32 (20.3%)</td>
<td>0.423</td>
</tr>
<tr>
<td>Survival to discharge</td>
<td>10 (5.6%)</td>
<td>6 (3.8%)</td>
<td>0.431</td>
</tr>
</tbody>
</table>

Combination: Vasopressin vs Epinephrine

Patients with out of hospital cardiac arrest

Randomized double blind control trial (Singapore)

Epinephrine 1mg PLUS standard of care*
  n= 353

Vasopressin 40 IU PLUS Standard of care*
  n= 374

Primary End Point: survival to hospital discharge; ROSC;

*Meaning 2005 ACLS guidelines (Epinephrine 1mg given ~95% after study drug)

Combination study

• Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Epinephrine</th>
<th>Vasopressin</th>
<th>Adjusted P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROSC</td>
<td>106 (30%)</td>
<td>119 (31.8%)</td>
<td>0.331</td>
</tr>
<tr>
<td>Survival to admission</td>
<td>59 (16.7%)</td>
<td>83 (22.2%)</td>
<td>0.051</td>
</tr>
<tr>
<td>Survival to discharge or 30 days post arrest</td>
<td>8 (2.3%)</td>
<td>11 (2.9%)</td>
<td>0.271</td>
</tr>
</tbody>
</table>

• No difference in cerebral performance category at 30 days and 1 year post arrest

NEJM: Vasopressin vs Epinephrine

Patients with out of hospital cardiac arrest

Randomized double blind control trial

Epinephrine 1mg PLUS
Vasopressin 40 IU
n = 1442

Epinephrine 1mg
PLUS
Placebo
n = 1452

Primary End Point: survival to hospital discharge; ROSC;

NEJM combination study

• Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Combination</th>
<th>Epinephrine only</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROSC</td>
<td>413 (28.6%)</td>
<td>428 (29.5%)</td>
<td>0.62</td>
</tr>
<tr>
<td>Survival to admission</td>
<td>299 (20.7%)</td>
<td>310 (21.3%)</td>
<td>0.69</td>
</tr>
<tr>
<td>Survival to discharge</td>
<td>24 (1.7%)</td>
<td>33 (2.3%)</td>
<td>0.24</td>
</tr>
<tr>
<td>1-year survival</td>
<td>18 (1.3%)</td>
<td>30 (2.1%)</td>
<td>0.09</td>
</tr>
<tr>
<td>Good neurologic recovery at discharge</td>
<td>9 (37.5%)</td>
<td>17 (51.5%)</td>
<td>0.29</td>
</tr>
</tbody>
</table>

Vasopressor Summary

• **Vasopressin offers no advantage** as a substitute or in combination with epinephrine

• **Vasopressin has been removed** from the ACLS 2015 adult cardiac arrest algorithm to simplify ACLS regimen

• **Epinephrine is the catecholamine/vasopressor of choice** in adult cardiac arrest

ROSC

I got a pulse!!

http://www.rcrmctraining.org/job_education/alaris/etco2/t1/p04.htm
Lidocaine after ROSC

• 2010: Not recommended

• 2015: “Currently inadequate evidence to support the routine use of lidocaine after cardiac arrest. However, the initiation or continuation of lidocaine may be considered immediately after ROSC from cardiac arrest due to VF/pVT”

Lidocaine after ROSC

- Retrospective multi-variate cohort analysis
- Study Group: Witnessed OHCA due to VT/VF
- Intervention: Lidocaine upon first documented ROSC in absence of VT/VF
  - Primary outcome:
    - Re-arrest from recurrent VF/VT after initial ROSC,
    - Admission to hospital,
    - Survival to hospital discharge

Limitations

- Lidocaine group: shorter time from EMS dispatch to ROSC (18.6 mins vs. 25.2 mins; P<0.001)
- Independent association (not-causal)

Half way there...Living on a prayer?

- Patient is unresponsive...
Targeted Temperature Management

• 2010: “comatose adult patients with ROSC after out-of-hospital VF cardiac arrest should be cooled to 32C to 34C for 12-24 hours. Induced hypothermia also may be considered for comatose adult patients with ROSC after IHCA (In-Hospital Cardiac Arrest) of any initial rhythm or after OHCA with an initial rhythm of pulseless electrical activity or asystole”

• 2015: “all comatose patients with ROSC after cardiac arrest should have TTM, with a target temperature between 32-36 selected and achieved, then maintained constantly for 24 hours”

• 2015: “Recommend AGAINST the use of routine prehospital cooling of patients after ROSC with rapid infusion of cold IV fluids”

Targeted Temperature Management

• 936 patients with OHCA
  – 33°C – 473 patients
    • 235 died (50%)
  – 36°C – 466 patients
    • 225 died (48%)

Targeted Temperature Management

• Pre-hospital cooling
  – Kim et al.
    • Found an increase in pulmonary edema and re-arrest among patients treated with a goal of prehospital infusion of 2 L of cold fluids

• Targeted temperatures
  – Higher temperatures might be preferred in patients for whom lower temperatures convey some risk (bleeding)
  – Lower temperatures might be preferred when patients have clinical features that are worsened at higher temperatures (seizures, cerebral edema)


Naloxone

• 2015: “For patients with known or suspected opioid addiction who are unresponsive with no normal breathing but a pulse, it is reasonable for appropriately trained lay rescuers and BLS providers...to administer intramuscular (IM) or intranasal (IN) naloxone”
Naloxone

- Available in IV, IM, SQ, IN, Nebulizer

- Most common forms in BLS or out of hospital situations
  - Intranasal: initial dose 2mg repeated every 3 to 5 minutes as needed
  - Auto-injector (single dose): 0.4mg IM repeated every 3 to 5 minutes as needed

Summary

• Compression Rate: 100-120 compressions/min
• Compression Depth: 2in-2.4in
• Vasopressin removed from algorithm
• Lidocaine?
• Targeted temperature management 32°C-36°C
• Naloxone addition
Other Updates

• BLS/CPR
  – Check for pulse and look for normal respirations at the same time
    • 5-10 seconds maximum
  – Ventilation rate with advanced airway
    • 1 breath every 6secs; no pausing of compressions
  – Full chest recoil between chest compressions
  – Manual compressions remain standard
    • Mechanical chest compression devices no demonstrated benefit

• ACLS
  – No routine use of O₂ in ACS with normal O₂ Saturation (SPO₂<94%)

Source: Grandview Team Pharmacy
EPINEPHRINE  
ATROPINE  
MAGNESIUM  
LIDOCAINE  
NALOXONE  
DIPHENHYDRAMINE  
MAGNesium  
CHLORIDE  
NOREPINEPHRINE  
CALCIUM  
CHLORIDE  
AMIODARONE  
ADENOSINE  

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