WHAT’S NEW WITH THE ACLS & BLS GUIDELINES?
Nicole Kupchik, MN, RN, CCNS, CCRN, PCCN-CMC

- Clinical Nurse Specialist
- Former Code Blue Committee Chair
- Currently consultant
- Staff Nurse
4-Part Resuscitation Webinar Series

Oct. 26 – “What’s New With the ACLS & BLS Guidelines?”

Nov. 30 – “High Quality CPR & Why It Matters!”

Dec. 20 – “Capnography: It’s about more than ventilation!”

Feb. 1 – “My Patient was Resuscitated, Now What?”
Disclosures

- Speaker’s Bureau: Physio-Control, Medtronic, Mallinckrodt
- Consultant: Physio-Control
Objectives

- Discuss the 2015 ACLS & BLS Guidelines
- Describe the components of high quality CPR
- Discuss the evidence behind recommended medications
2015 ACLS/BLS Guidelines:

https://eccguidelines.heart.org/index.php/amERICAN-HEART-ASSOCIATION/
Educational manuals available
New AHA Classification System for Classes of Recommendation and Levels of Evidence

**CLASS (STRENGTH) OF RECOMMENDATION**

**CLASS I (STRONG)**
- Benefit >> Risk
- Suggested phrases for writing recommendations:
  - Is recommended
  - Is indicated/useful/effective/beneficial
  - Should be performed/administered/other
  - Comparative-Effectiveness Phrases:
    - Treatment/strategy A is recommended/indicated in preference to treatment B
    - Treatment A should be chosen over treatment B

**CLASS IIa (MODERATE)**
- Benefit >> Risk
- Suggested phrases for writing recommendations:
  - Is reasonable
  - Can be useful/effective/beneficial
  - Comparative-Effectiveness Phrases:
    - Treatment/strategy A is probably recommended/indicated in preference to treatment B
    - It is reasonable to choose treatment A over treatment B

**CLASS IIb (WEAK)**
- Benefit ≈ Risk
- Suggested phrases for writing recommendations:
  - May/might be reasonable
  - May/might be considered
  - Usefulness/effectiveness is unknown/unclear/uncertain or not well established

**CLASS III: No Benefit (MODERATE)**
- Benefit ≈ Risk
- Suggested phrases for writing recommendations:
  - Is not recommended
  - Is not indicated/useful/effective/beneficial
  - Should not be performed/administered/other

**CLASS III: Harm (STRONG)**
- Risk > Benefit
- Suggested phrases for writing recommendations:
  - Potentially harmful
  - Causes harm
  - Associated with excess morbidity/mortality
  - Should not be performed/administered/other

**LEVEL (QUALITY) OF EVIDENCE**

**LEVEL A**
- High-quality evidence↓ from more than 1 RCTs
- Meta-analyses of high-quality RCTs
- One or more RCTs corroborated by high-quality registry studies

**LEVEL B-R (Randomized)**
- Moderate-quality evidence↓ from 1 or more RCTs
- Meta-analyses of moderate-quality RCTs

**LEVEL B-NR (Nonrandomized)**
- Moderate-quality evidence↓ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies
- Meta-analyses of such studies

**LEVEL C-LD (Limited Data)**
- Randomized or nonrandomized observational or registry studies with limitations of design or execution
- Meta-analyses of such studies
- Physiological or mechanistic studies in human subjects

**LEVEL C-EO (Expert Opinion)**
- Consensus of expert opinion based on clinical experience

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COR and LOE are determined independently (any COR may be paired with any LOE). A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective. The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information). For comparative-effectiveness recommendations (COR I and IIa; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated. The method of assessing quality is evolving, including the application of standards, widely used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

COR indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.
# Incidence of cardiac arrest

<table>
<thead>
<tr>
<th>Out-of-hospital (OHCA):</th>
<th>In-Hospital (IHCA):</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015 –</td>
<td>2015 –</td>
</tr>
<tr>
<td>□ 326,200</td>
<td>Incidence estimated at</td>
</tr>
<tr>
<td>□ 45.9% received</td>
<td>209,000</td>
</tr>
<tr>
<td>bystander CPR</td>
<td></td>
</tr>
<tr>
<td>□ 10.6% survival</td>
<td></td>
</tr>
</tbody>
</table>
According to the GWTG database, the survival rate from in-hospital cardiac arrest is:

A. 8.6%
B. 25.5%
C. 42.6%
D. 58.4%

Correct answer: B. 25.5%
What is the most common type of in-hospital cardiac arrest?

A. PEA and Asystole
B. Vfib and PEA
C. Vtach and Vfib
D. Asystole and Vfib

Asystole and Pulseless Electrical Activity (PEA) make up 67% of all adult in-hospital cardiac arrests.
• Approximately 80% of IHCA had abnormal vital signs documented 8 hours before their arrest
• More than 50% of cardiac arrests are due to respiratory failure & hypovolemic shock
What can we do to improve?

- Prevent the arrest!
  - Hospital focus is to respond once the arrest has occurred
- Resuscitate those who are resuscitatable!

#1 CPR Quality
#2 Early & effective defibrillation
#3 Post-Arrest temperature control
#4 Feedback to teams on performance
#5 Measure, practice & improve!!!
How long do healthcare providers retain their CPR skills after training?

A. 2 years
B. 1 year
C. 6 months
D. 3 months
E. < 3 months

✓ E. < 3 months
Maintenance of competency

The innovative competency-based training program for high-quality CPR and improved patient outcomes

Figure 1. Average Skill Loss

Skill Decline in CPR/AED Trainees

<table>
<thead>
<tr>
<th>% Passing Skills Test</th>
<th>3 months</th>
<th>6 months</th>
<th>12 month</th>
</tr>
</thead>
<tbody>
<tr>
<td>34%</td>
<td>27%</td>
<td>10%</td>
<td></td>
</tr>
</tbody>
</table>

http://www.heart.org/HEARTORG/General/Resuscitation-Quality-Improvement_UCM_459324_SubHomePage.jsp
“Poor quality CPR should be considered a preventable harm”

Compression rate mantra in 2010 - “Push fast, push hard”

Too Slow
(Before 2010)

Too Fast
(current)

100 – 120 /min
Chest Compression Fraction

- The amount of time spent providing compressions
- May also be called “chest compression ratio”

- Goal: As high as possible!
  - Guidelines: at least 60%
  - High performing hospitals & EMS: > 80 – 90%

Is it acceptable to be off the chest for 40% of an arrest?
ROC Study group; OHCA, survival to discharge

Continuous 2 minutes of compressions without pauses in compressions for breathing vs.

Chest compressions with pauses for breathing

Enrolled over 23,000 patients in 8 regions across the U.S. & Canada
And the results are…

A. 30 compressions : 2 ventilations
B. 2 minutes continuous compressions with ventilations every 6 seconds?
C. The outcomes were the same; no statistical difference

### 2015 CPR Quality Levels of Evidence – ILCOR/AHA

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Class</th>
<th>LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest Compression Rate 100 – 120 / minute</td>
<td>IIa</td>
<td>C-LD</td>
</tr>
<tr>
<td>Chest Compression Depth 2”- 2.4”</td>
<td>I</td>
<td>C-LD</td>
</tr>
<tr>
<td>Chest Compression Fraction should be as high as possible, with a minimum &gt;60%</td>
<td>IIb</td>
<td>C-LD</td>
</tr>
<tr>
<td>Minimizing Pre &amp; Post-shock pauses</td>
<td>I</td>
<td>C-LD</td>
</tr>
<tr>
<td>Allowing full recoil of the chest wall</td>
<td>IIa</td>
<td>C-LD</td>
</tr>
</tbody>
</table>

CC Rate 141
### CPR QUIK-VIEW

<table>
<thead>
<tr>
<th>Time</th>
<th>Compr. ratio (%)</th>
<th>Compr. rate</th>
<th>Compr. depth</th>
<th>With target depth</th>
<th>Good compr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:00</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>1:00</td>
<td>56</td>
<td>104</td>
<td>1.8</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>2:00</td>
<td>100</td>
<td>105</td>
<td>1.9</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>3:00</td>
<td>79</td>
<td>104</td>
<td>1.5</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>4:00</td>
<td>94</td>
<td>107</td>
<td>1.5</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>5:00</td>
<td>89</td>
<td>118</td>
<td>1.4</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>6:00</td>
<td>100</td>
<td>118</td>
<td>1.2</td>
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<td>--</td>
</tr>
<tr>
<td>7:00</td>
<td>81</td>
<td>116</td>
<td>1.8</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>8:00</td>
<td>94</td>
<td>114</td>
<td>1.7</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>9:00</td>
<td>100</td>
<td>110</td>
<td>1.6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
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<td>93</td>
<td>109</td>
<td>1.7</td>
<td>8</td>
<td>7</td>
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<tr>
<td>11:00</td>
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<td>112</td>
<td>1.9</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
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<td>110</td>
<td>1.8</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
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<td>100</td>
<td>105</td>
<td>2.0</td>
<td>63</td>
<td>57</td>
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<tr>
<td>14:00</td>
<td>95</td>
<td>106</td>
<td>1.8</td>
<td>35</td>
<td>35</td>
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<tr>
<td>15:00</td>
<td>47</td>
<td>--</td>
<td>0.6</td>
<td>--</td>
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</tbody>
</table>
AVOID excessive ventilation!!!

- If patient does not have an advanced airway:
  Adults 30:2, Peds 15:2
  Do you stop compressions for ventilations? YES

- If the patient has an advanced airway:
  10 breaths/min
  (1 breath every 6 seconds)
  Do you stop compressions for ventilations? NO

-2015 BLS/ACLS Guidelines

Issues: Too many breaths, too large a tidal volume
AVOID excessive ventilation!!!

“If patient does not have an advanced airway:

Adults 30:2, Peds 15:2

Do you stop compressions for ventilations? YES

“If the patient has an advanced airway:

10 breaths/min (1 breath every 6 seconds)

Do you stop compressions for ventilations? NO

-2015 BLS/ACLS Guidelines

“Hyperventilation Kills”

-ECCU Conference 2015
Summary

Compression count = 1526
Pauses over 10 sec = 4
Longest compression pause = 0:32

CPR QUIK-VIEW

Interval Statistics

<table>
<thead>
<tr>
<th>Compr. ratio, %</th>
<th>Compr. rate</th>
<th>Vent. rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>88</td>
<td>144</td>
<td>--</td>
</tr>
<tr>
<td>81</td>
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<td>100</td>
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<td>80</td>
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<td>100</td>
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<td>86</td>
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<td>44</td>
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<td>25</td>
</tr>
<tr>
<td>100</td>
<td>153</td>
<td>25</td>
</tr>
</tbody>
</table>

Shock | Time | Energy | Pre-shock CPR pause | Post-shock CPR pause |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0:11</td>
<td>200J</td>
<td>0:00</td>
<td>0:00</td>
</tr>
<tr>
<td>2</td>
<td>1:31</td>
<td>300J</td>
<td>0:08</td>
<td>0:04</td>
</tr>
<tr>
<td>3</td>
<td>4:12</td>
<td>360J</td>
<td>0:00</td>
<td>0:00</td>
</tr>
<tr>
<td>4</td>
<td>6:34</td>
<td>360J</td>
<td>0:06</td>
<td>0:03</td>
</tr>
<tr>
<td>5</td>
<td>11:30</td>
<td>360J</td>
<td>0:10</td>
<td>0:03</td>
</tr>
</tbody>
</table>
Waveform Capnography

- Attaches to ET tube, measures end tidal CO₂
- Can also be used with a BVM
When to use Waveform Capnography?

- Gold standard for endotracheal tube placement
  - Level 1C-LD recommendation AHA/ILCOR
- Tube position - dislodgement
- Procedural/moderate - deep sedation
- High risk patient on PCA pump
- Cardiac arrest
  - Quality indicator of compressions
  - Information helpful to determine cessation of resuscitation efforts
- Post arrest – fluid responsiveness
Continuous Waveform Capnography

- Normal PeTCO$_2$ = 35 – 45 mmHg
- Correlates with PaCO$_2$ in normal V/Q relationships
  - < 5 mmHg difference
- In cardiac arrest - < 10 improve CPR quality
### 2015 Capnography & Ventilation

**Levels of Evidence – ILCOR/AHA**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Class</th>
<th>LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Waveform Capnography to verify ETT placement</td>
<td>I</td>
<td>C-LD</td>
</tr>
<tr>
<td>Capnography as a measure of CPR quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capnography as an indicator of ROSC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low PEtCO₂ (&lt; 10 mmHg) after 20 minutes in intubated patients is strongly associated with failure of resuscitation</td>
<td>IIb</td>
<td>C-LD</td>
</tr>
<tr>
<td>Should not be used in isolation or in non-intubated patients as a marker to terminate resuscitation</td>
<td>III</td>
<td></td>
</tr>
<tr>
<td>Ventilation rate 10 breaths per minute with an advanced airway</td>
<td>IIb</td>
<td>C-LD</td>
</tr>
</tbody>
</table>

DEFIBRILLATION
Ventricular fibrillation

- Most successful treatment for v-fib is defibrillation!
- For every minute delay, survival decreases by 7 - 10% without bystander CPR!!!

Effects of compression depth and pre-shock pauses predict defibrillation failure during cardiac arrest

Dana P. Edelson\textsuperscript{a}, Benjamin S. Abella\textsuperscript{b,*}, Jo Kramer-Johansen\textsuperscript{c,d}, Lars Wik\textsuperscript{c,d,e,f}, Helge Myklebust\textsuperscript{g}, Anne M. Barry\textsuperscript{b}, Raina M. Merchant\textsuperscript{b}, Terry L. Vanden Hoek\textsuperscript{b}, Petter A. Steen\textsuperscript{c,d,f,h}, Lance B. Becker\textsuperscript{i}
Pauses are bad. Very bad.

- OHCA, observational study
- Evaluated pauses in all rhythms including PEA & asystole
- Survival decreased 11% per 5 second increase in duration of longest overall pause
- Individual long pauses may be more harmful than multiple short pauses even if the overall CCF is similar

Compressions

37 sec non-shock pause

Compressions
High Performance Team

- Clear team leader
- Understand not only your role, but the role of others on the team
- Anticipate what needs to happen next
<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Class</th>
<th>LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>For manual defibrillators, pre &amp; post shock pauses as short as possible.</td>
<td>I</td>
<td>C-LD</td>
</tr>
<tr>
<td>Immediately resume chest compressions after shock delivery in adults in cardiac arrest in any setting</td>
<td>IIb</td>
<td>C-LD</td>
</tr>
<tr>
<td>Defibrillators with bi-phasic waveforms are preferred to monophasic for treatment of atrial or ventricular arrhythmias. Peds biphasic – 2 J/kg, then 4 J/kg, max 10 J/kg</td>
<td>IIa</td>
<td>B-R</td>
</tr>
<tr>
<td>Use manufacturer's recommended energy dosing</td>
<td>IIb</td>
<td>C-LD</td>
</tr>
<tr>
<td>Single shock strategy is suggested (vs. stacked)</td>
<td>IIa</td>
<td>B-NR</td>
</tr>
</tbody>
</table>
MEDICATIONS
Which of the following medications has been shown to increase survival to discharge from cardiac arrest?

A. Epinephrine
B. Vasopressin
C. Bicarb
D. Amiodarone
E. None of the above
Emergency medications – V-fib

- **Epinephrine** 1 mg every 3 - 5 min
  - Peds 0.01 mg/kg

- **Vasopressin** - Removed from Cardiac Arrest Algorithm!

- **Amiodorone** 300 mg, repeat 150 mg
  - Peds – 5mg/kg, repeat up to 2 times
Studies questioning the use, timing, efficacy of Epinephrine

- Dumas et al (2014) J Amer College of Card*
- Olasveengen et al (2012) Resuscitation*
- Hagihara et al (2012) JAMA*
- Jacobs et al (2011) Resuscitation*
- Olasveengen et al (2009) JAMA*
- Paradis et al (1991) JAMA

*Epi associated with worse outcomes
Is Epinephrine beneficial or does it cause harm?

- Current recommendation: 1 mg Q 3 – 5 min
- RCT Epi vs. Placebo
- Warwick University
- UK & Wales
- Enrollment started Sept 2014
- 8,000 subjects
- Out-of-Hospital Cardiac Arrest
- Paramedic2 Trial
- Results in 2018!

http://www2.warwick.ac.uk/fac/med/research/hscience/ctu/trials/critical/paramedic2/about/
ALP Trial

- **Amiodorone** vs.
- **Lidocaine** vs.
- **Placebo**

- Out of hospital v-fib arrest
- Goal is drug administration < 10 minutes after arrival on scene

- Resuscitation Outcome Consortium (ROC) study group
- Multi-city EMS trial
- Goal: 3,000 patients
And the winner is….

A. Amiodarone
B. Lidocaine
C. Both are beneficial
D. Neither

Kudenchuk et al. (2016) NEJM
## 2015 Medications
Levels of Evidence – ILCOR/AHA

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Class</th>
<th>LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard dose Epinephrine (1 mg q 3 -5 min) may be reasonable</td>
<td>IIb</td>
<td>B-R</td>
</tr>
<tr>
<td>High dose Epinephrine is not recommended (No benefit)</td>
<td>III</td>
<td></td>
</tr>
<tr>
<td>Vasopressin has no advantage as a substitute <em>(Removed)</em></td>
<td>IIb</td>
<td>B-R</td>
</tr>
<tr>
<td>Amiodarone may be considered for Vf/pVT unresponsive to CPR, defib and vasopressor therapy</td>
<td>IIb</td>
<td>B-R</td>
</tr>
<tr>
<td>Lidocaine may be considered as an alternative to Amiodarone</td>
<td>IIb</td>
<td>B-R</td>
</tr>
<tr>
<td>Magnesium for VF/pVT is not recommended (No benefit)</td>
<td>III</td>
<td></td>
</tr>
<tr>
<td>It is reasonable to establish IO access if IV access is not readily available (from 2010)</td>
<td>IIa</td>
<td>C</td>
</tr>
</tbody>
</table>

In conclusion...

- Thank you for participating in this webinar.
- Prevent the arrest!
- Focus on high quality CPR & early defibrillation
- Capnography should be used to verify endotracheal tube placement
- Avoid excessive ventilation
- Stay tuned for updates on medications