What’s New in Cardiac Resuscitation: 
The American Heart Association Guidelines for ACLS and BLS

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MN, RN, CCNS, CCRN, PCCN, CMC
Our Moderator

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Clinical Educational Specialist, Overlake Medical Center, Seattle, WA
- Facilitate patient care services hospital wide orientation for nurses
- Content expert for hospital wide cardiac policies and procedures

Cardiology Clinical Nurse Specialist, Harborview Medical Center, Seattle, WA
- Co-chair of the code blue committee
- Facilitated and developed the educational plan for the development of the surgical airway code
Our Speaker

Nicole Kupchik MN, RN, CCNS, CCRN, PCCN, CMC
- Clinical Nurse Specialist
- Former Code Blue Committee Chair
- Currently consultant
- Staff Nurse

National Resuscitation Presentations:
- American Heart Association (AHA)
- Emergency Cardiovascular Care Updates (ECCU)
- Society of Critical Care Medicine (SCCM)
- National Teaching Institute (NTI)
- Emergency Nurses Association (ENA)
Disclosures

- Speaker’s Bureau: Physio-Control/Stryker, Medtronic, Mallinckrodt
- Consultant: Physio-Control/Stryker
Continuing Education for Nurses and Respiratory Therapists

- This educational activity is approved for 1 contact hour.
- Saxe Healthcare Communications is accredited as a provider for continuing education by the American Nurses’ Credentialing Center’s Commission on Accreditation. Provider approved by California Board of Nursing. Provider #14477 and the Florida Board of Nursing Provider # 50-17032
- This program has been approved for 1.0 contact hours Continuing Respiratory Care Education (CRCE) credit by the American Association of Respiratory Care, 9425 N. MacArthur Blvd. Suite 100, Irving, TX 75063.
- A link to obtain CE credits will be available at the conclusion of the webinar
- Support for this educational activity provided by Physio-Control
Learning Objectives

Upon completion of this activity, the participant will be able to:
1. Discuss the 2015 ACLS & BLS Guidelines
2. Describe the components of high quality CPR
3. Recognize the importance of early and effective defibrillation
4. Discuss the evidence behind recommended medications
Saving Lives Webinar Series

June: What’s New with the ACLS & BLS Guidelines?

September: High Quality CPR & Why It Matters!

October: Capnography: It’s about more than ventilation!

November: My Patient was Resuscitated, Now What?
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
  - 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-RR (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

**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 II; LOE A and B only), studies that support the use of comparator works should make direct comparisons of the treatments or strategies being evaluated.
- The method of assessing quality is evolving, including the application of standardized, widely used, and generally validated evidence grading tools; for systematic reviews, incorporation of an Evidence Review Committee.

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

Out-of-hospital (OHCA):
2015 –
- 326,200
- 45.9% received bystander CPR
- 10.6% survival

In-Hospital (IHCA):
2015 –
Incidence estimated at 209,000
Question: 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%
Question: 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
Hospital chain of survival

- 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 and effective defibrillation
#3 Post-Arrest temperature control
#4 Feedback to teams on performance
#5 Measure, practice and improve!!!
CPR Quality
Question: 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 ✔
Maintenance of competency

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

Figure 1. Average Skill Loss

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)

100 – 120 /min

Too Fast (current)
Chest Compression Fraction

- The % 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 US & 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

<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
## Minute by minute breakdown

### CPR QUIK-VIEW

<table>
<thead>
<tr>
<th>Time (min)</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>1.6</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>
<td>--</td>
<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>
<td>10.00</td>
<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>
<td>100</td>
<td>112</td>
<td>1.9</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>12.00</td>
<td>94</td>
<td>110</td>
<td>1.8</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>13.00</td>
<td>100</td>
<td>105</td>
<td>2.0</td>
<td>63</td>
<td>57</td>
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<tr>
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<td>95</td>
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<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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</table>
AVOID excessive ventilation!!!

“Hyperventilation Kills”

ECCU Conference 2015
Should we put an emphasis on intubation in the first 15 minutes?

Andersen et al (2017) JAMA; 317:5
Waveform Capnography

- Attaches to ET tube, measures end tidal CO$_2$
- 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 $\text{PETCO}_2 = 35 – 45 \text{ mm Hg}$
- Correlates with $\text{PaCO}_2$ in normal V/Q relationships
  - $< 5 \text{ mm Hg}$ difference
- In cardiac arrest - $< 10 \text{ mm Hg}$; improve CPR quality
<table>
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</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 PEtCO$_2$ (&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!!!

N = 13, 053
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 and 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**

**Other Code Blue Team Members:**
- **Lab:** Performs blood gas analysis ensures the team is aware of the results.
- **Spiritual Care:** Stays with family during resuscitation.
- **Nursing Supervisor:** Ensures adequate staff on unit; assigns ICU bed if needed.
### 2015 Defibrillation Levels of Evidence – ILCOR/AHA

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<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
Question: 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!
- **Amiodarone** 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

- Amiodarone 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

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<tr>
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<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 (Removed)</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>Ila</td>
<td>C</td>
</tr>
</tbody>
</table>

In conclusion,

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

**Next webinar:** September 20th – High Quality CPR and Why It Matters!
Our Moderator
This activity has approved this program for 1.0 contact hour of CRCE and CNE by the AARC and California Board of Nursing and the Florida Board of Nursing.

Go to [http://www.saxetesting.com/sl](http://www.saxetesting.com/sl)

You will need to register on the test site. Complete the evaluation form.

Upon successful submission, you will be able to print your certificate of completion.

**Accreditation**

- American Association for Respiratory Care, 9425 N. MacArthur Blvd., Suite 100, Irving, TX 75063.
- Provider (Saxe Communications) is approved by the California Board of Registered Nursing. Provider # 14477 and Florida Board of Nursing. Provider # 50-17032
An archive/on-demand version will be available on www.savinglivesnow.org
An email will be sent to all registrants when it is available
The on-demand version will be accredited for nurses and respiratory therapists
Questions

Christine Laux

Nicole Kupchik