Resuscitation post Cardiac Arrest for Anesthesiologists (A-ACLS), A Different Algorithm?

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Division of Critical Care Medicine
University of Florida

The Gator Football Team: 90,000 seats for a town of 100,000 people!

Sunny Florida

1851 - 2010 Tropical Cyclones and Hurricanes Path in Florida

A small viper in my pool... And a small alligator...
COI:
AHA Liaison for the ASA 2005-2013

Guidelines 2010
..but what about here?

PubMed End of 2013
16,000 + manuscripts on CPR

Pubmed End of 2013
16,000 + manuscripts on CPR

OR
Post ROSC care

Epidemiology of CA
• 200,000 out of hospital: survival 8%
  Merchant 2011 Nov;39(11): 2401-6
• Sudden Cardiac Death (Coronary) at least ½ but still not well defined
  Kong JACC 2011 57(7) :794
• 50,000 in hospital: survival 22%
  Girotra NEJM 2012, 367 1912-20
  Kazaure Resuscitation 2013 in press

Ahamed Idris and apprentice..

NRCPR Data From About 400 US Hospitals
Cardiac Arrest in the OR
An American View

- 0.6/10,000 anesthetics but underreported
- 100 times as much in peds (neonates)
- 20 Millions + of anesthetics/year in the US
- 30 years career
- 30,000 Chances of Cardiac Arrest
- 25,000 + MD Anesthesiologists

IT WILL HAPPEN TO YOU!

Anesthesiology 2002; 97:1609-1617
Anesthesiology 2014;120 (4):829-838

Surgical Perspective
ACS-NSQIP 2005-10 (1.3 M Cases)

- 6382 cardiac arrest
- 85.9% postoperatively
- 71.6% 30 days mortality
- 19.2% survival to discharge

Who...

Are We (Anesthesia People) Up To The Task?

Sch Westbrook, Anesthesiology;76,1992

Sprung at al. Anesthesiology 99(2): 259-269; 2003

Is There a Hope?

518,294 Anesthetics for Non Cardiac Surgery at the Mayo Clinic in 10 Years
Mostly Asystole, 50% Airway Related
The “NO Ventilation” in CPR... Does it Apply to Us?

NO BLS = NO ACLS!!

Chest Compression Rate < 70 minute = NO ROSC

Yu T et al: Circulation 2002;106:368-72

“Advancing C:V Ratio Make Sense” DO2 Approach


The Effect of Ventilation During CPR on Coronary Perfusion

## CCC CPR: Data from Japan

### 1-Year Neurological Outcome

<table>
<thead>
<tr>
<th>No CPR</th>
<th>Cardiac Only</th>
<th>Conventional CPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM CPR 0-15 mm Hg (n=3058)</td>
<td>75/937 (2.4)</td>
<td>25/1574 (1.5)</td>
</tr>
<tr>
<td>Associated OR (95% CI)</td>
<td>1.72 (1.01-2.95)</td>
<td>1.57 (0.95-2.66)</td>
</tr>
<tr>
<td>BM CPR 16-29 mm Hg (n=268)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associated OR (95% CI)</td>
<td>2.22 (0.85-5.93)</td>
<td>1.87 (0.66-5.44)</td>
</tr>
<tr>
<td>BM CPR 30 mm Hg (n=120)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associated OR (95% CI)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Favorable 1-year neurological outcome, n (%)</th>
<th>Reference</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Favorable 1-year neurological outcome, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Favorable 1-year neurological outcome, n (%)</td>
<td>579 (6.6)</td>
<td>759 (2.7)</td>
</tr>
<tr>
<td>Favorable 1-year neurological outcome, n (%)</td>
<td>25/300 (8.3)</td>
<td>19/366 (5.2)</td>
</tr>
<tr>
<td>Favorable 1-year neurological outcome, n (%)</td>
<td>1.45 (0.75-2.73)</td>
<td>1.45 (0.66-2.49)</td>
</tr>
</tbody>
</table>

*Significant p<0.01

Iwami T. Circulation. 2007;116:2900-2907

### Rescue Breathing in CPR

**Dysrhythmic vs Asphyxial Arrest**

<table>
<thead>
<tr>
<th>SaO2</th>
<th>Pao2</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC + RB</td>
<td>92±2*</td>
<td>34±2</td>
</tr>
<tr>
<td>CC</td>
<td>76±6</td>
<td>37±5</td>
</tr>
</tbody>
</table>

*Significant p<0.01

Berg, Circulation 1997

<table>
<thead>
<tr>
<th>SaO2</th>
<th>Pao2</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC + RB</td>
<td>97±4*</td>
<td>45±4</td>
</tr>
<tr>
<td>CC</td>
<td>97±5</td>
<td>7.31±0.6</td>
</tr>
</tbody>
</table>

*Significant p<0.01

Berg, CCM 1999

### Pediatric Bystander CPR

**30-day Neuro Survival**

<table>
<thead>
<tr>
<th>CC + RB</th>
<th>CC Only</th>
<th>No CPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>45/624*</td>
<td>6/380*</td>
<td>53/2719</td>
</tr>
<tr>
<td>7.2%</td>
<td>1.6%</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

*Significant p<0.01

Kitamura, Lancet 2010

### Ventilation in Cardiac Arrest

**If 100% blood flow then 100% ventilation = 100-120mL/min/kg**

**If 20-30% blood flow then 20-30% ventilation = 6/min x 4-5 mL/kg**

But How Much?
### Definitions: Δ Pulse Pressure & Δ Systolic Pressure

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Hypoventilation</th>
<th>Control</th>
<th>Hyperventilation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minute ventilation</td>
<td>70 ± 11</td>
<td>140 ± 23</td>
<td>274 ± 41</td>
</tr>
<tr>
<td>End-tidal CO₂ (torr)</td>
<td>19 ± 9</td>
<td>14 ± 6</td>
<td>8 ± 4</td>
</tr>
<tr>
<td>Arterial Blood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>7.07 ± 0.06</td>
<td>7.20 ± 0.12</td>
<td>7.27 ± 0.13</td>
</tr>
<tr>
<td>PCO₂ (torr)</td>
<td>44 ± 9</td>
<td>33 ± 7</td>
<td>24 ± 6</td>
</tr>
<tr>
<td>PO₂ (torr)</td>
<td>96 ± 53</td>
<td>127 ± 87</td>
<td>143 ± 139</td>
</tr>
<tr>
<td>HCO₃⁻ (mmol/L)</td>
<td>12 ± 4</td>
<td>13 ± 4</td>
<td>11 ± 3</td>
</tr>
<tr>
<td>Mixed Venous Blood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>6.96 ± 0.09</td>
<td>7.00 ± 0.11</td>
<td>7.00 ± 0.11</td>
</tr>
<tr>
<td>PCO₂ (torr)</td>
<td>67 ± 12</td>
<td>68 ± 11</td>
<td>68 ± 12</td>
</tr>
<tr>
<td>PO₂ (torr)</td>
<td>22 ± 8</td>
<td>23 ± 5</td>
<td>25 ± 6</td>
</tr>
<tr>
<td>HCO₃⁻ (mmol/L)</td>
<td>15 ± 5</td>
<td>16 ± 6</td>
<td>15 ± 5</td>
</tr>
</tbody>
</table>

HCO₃⁻, bicarbonate. p<.05 compared with hyperventilation; p<.05 compared with control. To convert torr to kPa, multiply the value by 0.133.

References:
- Michard et al. Am J Respir Crit Care Med 159:935-9, 1999
- Idris AH Crit Care Med Vol.22 n 11, 1994; 1827-34

Questions:
- How Much Ventilation in Low Flow State?
- What is the effect of different levels of ventilation on arterial blood gases and mixed venous blood gases?
- What are the implications of hyperventilation in the low flow state?
The Lazarus Phenomenon
38 cases of spontaneous ROSC after stopping CPR

Rembrandt 1620


35% discharge home neuro intact!!

What is “Quality CPR” in the OR?
Beyond rate depth and full chest recoil

Quality of CPR

CPR in Progress

How Are We Doing with “Quality”?

Pulse Check
- Femoral is unreliable
- Carotid gives no info on quality of CPR

E\textsubscript{T}CO\textsubscript{2}
Invasive Blood Pressure
Coronary PP
ScvO\textsubscript{2}
SaO\textsubscript{2}
Echocardiogram

“Anesthesia” Quality of CPR
E\textsubscript{T}CO\textsubscript{2}

CPP = Relaxation A Pressure – CVP or Simply BPD

“Anesthesia” Quality of CPR
CPP = Relaxation A Pressure – CVP or Simply BPD

Death by hyperventilation: A common and life-threatening problem during cardiopulmonary resuscitation
Tom P. Armstrong, MD, Keith L. Lune, MD

Crit Care Med 2004 Vol. 32, No. 9 (Suppl.)
A New Big Player in the ICU

Focused Echo Eval during Resuscitation “FEER”


Evaluating the role of TEE post ROSC after a “10 min” crash course

Echocardiography (TEE)


We Have Better Tools in the OR, and We Can Use Them without Interfering with quality CPR

Beyond the BIS Monitor

Computer Analysis of Anesthesia Depth (Multimodal Index of Consciousness EEG (AMIC))

Schneider Anesthesiology 2014 (120) 4: 819-828
Defibrillation in the Hospital How Fast?

- Circa 7000 shockable in hospital arrest
- (NRCPR data) in 369 hospitals
  - 30% within 2 minutes (D/C rate 39.3% vs 22%)
  - 87.2% in the OR (D/C rate 53 vs 39%)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>A = 7%</th>
<th>B = 11%</th>
<th>F Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead location</td>
<td>23.04</td>
<td>88.45</td>
<td>123.66</td>
</tr>
<tr>
<td>Post shock amp</td>
<td>44.00</td>
<td>67.00</td>
<td>1.11</td>
</tr>
<tr>
<td>Total shocks</td>
<td>35.00</td>
<td>78.00</td>
<td>0.54</td>
</tr>
<tr>
<td>Defibrillator</td>
<td>22.00</td>
<td>45.00</td>
<td>1.11</td>
</tr>
<tr>
<td>Fibrillation as</td>
<td>56.00</td>
<td>58.00</td>
<td>0.14</td>
</tr>
<tr>
<td>Time to Cardiac arrest</td>
<td>35.00</td>
<td>76.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

(For O-O-H the cut of point is between 6 to 7 minutes)

What Did We Learn About..

What Did We Learn About..

[Image: DRUGS]

Epi, no-Epi, Epi, no-Epi.. Is this a negative trial?

Every 40 patients 5 more can be alive after 1 year with Epi..

Epinephrine: Bad track Record..

- Bainbridge J Physiol. 1917;51:460–8
- Freeman. Am J Physiol. 1941;131:545–53
- Vissco M CCM 34(12) Suppl 2006: a454-a57
- Fries M CCM 34(12) Suppl 2006: a434-a57

Vasopressin and Diastolic Blood Pressure During CPR (mmHg):
Anecdotal Data in Human

<table>
<thead>
<tr>
<th>Epinephrine</th>
<th>Add vasopressine</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>15</td>
<td>35</td>
</tr>
<tr>
<td>15</td>
<td>50</td>
</tr>
<tr>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

Combining Epi and AVP:

Minestroni Soup:
Combining Epi AVP and Steroids (40% ICU Pts, only 17% Shockable)

Corticosteroids in Sepsis
Sprung CL. NEJM 2008;358:111-124

Amiodarone
- Better than nothing (ROSC)
- Better than Lidocaine (increase incidence of asystole)
- Better if in aqueous formulation
  – Somberg Am J Cardiol. 2004;93:576-81. (Prospective, 312 patients)
(Class IIB)

Sir or Madam, Do You Really Want CPR?
Something We Do Not Usually Ask in the Preoperative Evaluation: DNR Status

Yes
114/190 (60%)
No
76/190 (40%)

Yes
58/74 (74%)*
No
19/74 (26%)

Discussion of Implications of DNR Order with Patient/Guardian

The Truth of How the Patient Arrest is in the Anesthesia Record

Table 1. Professional Characteristics of the Participants.

<table>
<thead>
<tr>
<th>Position</th>
<th>Participants (N=12)</th>
<th>Years of Experience in Specialty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1 to 5)</td>
<td>6 to 10</td>
</tr>
<tr>
<td>Anesthesiology attending</td>
<td>17 (11)</td>
<td>0</td>
</tr>
<tr>
<td>physician</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical attending physician</td>
<td>2 (1)</td>
<td>0</td>
</tr>
<tr>
<td>Anesthesiology resident</td>
<td>10 (13)</td>
<td>0</td>
</tr>
<tr>
<td>Surgical resident†</td>
<td>2 (1)</td>
<td>0</td>
</tr>
<tr>
<td>Operating room nurse</td>
<td>30 (10)</td>
<td>0</td>
</tr>
<tr>
<td>Surgical technologist</td>
<td>9 (13)</td>
<td>0</td>
</tr>
<tr>
<td>Certified registered nurse</td>
<td>7 (10)</td>
<td>29</td>
</tr>
</tbody>
</table>

Arriaga NEJM 2013.368:3:246

Arriaga NEJM 2013.368:3:246

A-ACLS: Better By Checklist

Survey Statement

The checklist helped me feel better prepared during the emergency scenario.

The checklist was easy to use.

I would use this checklist if I were presented with this operative emergency in real life.

If I were having an operation and experienced this intra-operative emergency, I would want the checklist to be used.

Arriaga NEJM 2013.368:3:246
Yes, We Should Have a Check List to Use “Before” the Patient Arrests

Treat The Causes of the Arrest
(Our Causes, too)

DDx: 5H 5T

<table>
<thead>
<tr>
<th>H’ s</th>
<th>T’ s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoxia</td>
<td>Toxins</td>
</tr>
<tr>
<td>Hypovolemia</td>
<td>Tamponade (cardiac)</td>
</tr>
<tr>
<td>Hydrogen ion (acidosis)</td>
<td>Tension pneumothorax</td>
</tr>
<tr>
<td>Hypo-/hyperkalemia</td>
<td>Thrombosis, pulmonary</td>
</tr>
<tr>
<td>Hypothermia</td>
<td>Thrombosis, coronary</td>
</tr>
</tbody>
</table>

Our DDx

Anesthetic
- Intravenous anesthetic overdose
- Inhalation anesthetic overdose
- Neuraxial block/high level sympathectomy
- Local anesthetic systemic toxicity
- Malignant hyperthermia
- Drug administration errors

Cardiovascular
- Vasovagal reflex
- Hypovolemic and/or hemorrhagic shock
- Tension Pneumothorax
- Anaphylactic Reaction
- Transfusion Reaction
- Acute Electrolyte Imbalance (high k)
- Severe Pulmonary Hypertension
- Increased Intraabdominal pressure
- Pacemaker failure
- Prolonged QT syndrome
- Pulmonary Embolism
- Gas Embolism
- Oculocardiac reflexes
- Electroconvulsive therapy

Contributing Causes of Cardiac Arrest in the ICU

<table>
<thead>
<tr>
<th>The 6 Hs</th>
<th>The 5 Ts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoxia</td>
<td>Toxin</td>
</tr>
<tr>
<td>Hypo-/hyperkalemia</td>
<td>Tension pneumothorax</td>
</tr>
<tr>
<td>Hypervolemia</td>
<td>Hypothermia</td>
</tr>
<tr>
<td>Hypothermia</td>
<td>Pulmonary Embolism</td>
</tr>
<tr>
<td>Hypotension</td>
<td>Electroconvulsive therapy</td>
</tr>
</tbody>
</table>

Circulation 2005;112 (suppl):IV-58-66
30Y old, knee arthroscopy. IV versed/fentanyl epidural test dose 3ml 1.5% lido + epi, ascending paresthesias.

Brady….BANG!: You ARE in PEA/Asystole

- **Quality CPR**
- **No More Atropine!**
- **No Bicarbonate!**
- **No Calcium**
- **5 H s and 5 T s**

**Same Patients, 3:1 IA block with 20cc 0.5% bupivacaine**

My mouth start tingling… Brady/Hypothension…(+Seizure) then Asystole

- Intubate quickly
- High quality CPR always first
- Stop the administration of local anesthetic
- Epinephrine 1 mcg IV (consider high dose epi!!!)
- a new potion: 20% intralipid, 1.2–2 ml/kg IV load, then 0.25–0.5 ml/kg/hr IV
- Sodium Bicarbonate to maintain a pH greater than 7.25 in patients who do not respond quickly
- Consider transcutaneous or intravenous pacemakers for all bradycardic rhythms. Asystole can quickly come back to bradycardia after all the above
- Continue CPR as long as your monitor show you are effective, as very good neurologic recovery has been reported in patients after very prolonged cardiac arrests from local anesthetic overdoses.

**Lipid Emulsion and Cardiac Arrest**

**Mechanisms of action**
- Lipid Sink (sequestration of the poison out of target tissue)
- Salutary cardio tonic
- Salutary metabolic

**We Know How to Deal with Local Anesthetic Overdose…**

- Discontinue anesthetic or “offending” infusion, a polite “keep you hand off please”! To the surgeon
- Ventilate with 100% Oxygen, intubate trachea
- Begin CPR if no pressure regardless (100 to 8 asynchronous)
- Lots of Vagus = Use Anti Vagal! Atropine (what else?)
- Treat with at least 1 mg epinephrine IV (then a lot more, up to 0.1mg/kg)
- Consider concurrent treatment with 40 u vasopressin
- Get ready to pace if you are going to ROSC
- Continue CPR as long as monitoring show effectiveness!
Cardiac Arrest and Anaphylaxis

- Stop or remove the inciting agent or drug (e.g., IV contrast or latex) if feasible, stop surgery
- Oxygen 100%
- Airway in right away
- Open your IVs full speed
- Be Careful with 1 mg Epinephrine
- IV boluses 50 to 100 mics + start the infusion
- +2 u Vasopressin IV if there is no response
- LOWER LEVEL EVIDENCE
  - H1 blocker (50 mg diphenhydramine IV)
  - H2 blocker (20 mg famotidine IV)
  - + steroid (e.g., 50-150 mg hydrocortisone IV)
- USEFUL
  - a tryptase level in the blood can be used to confirm the diagnosis retrospectively

Successful Cardiopulmonary Resuscitation in the Lateral Position during Intraoperative Cardiac Arrest

Resuscitation the the Pregnant Patient... Gaps in Critical Knowledge

<table>
<thead>
<tr>
<th>Test</th>
<th>ANES n = 32</th>
<th>OB n = 27</th>
<th>EM n = 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Score</td>
<td>76 ± 15</td>
<td>63 ± 16</td>
<td>72 ± 13</td>
</tr>
<tr>
<td>LUD</td>
<td>73 ± 20</td>
<td>63 ± 21</td>
<td>62 ± 21</td>
</tr>
<tr>
<td>ACLS</td>
<td>83 ± 27</td>
<td>65 ± 36</td>
<td>93 ± 26†</td>
</tr>
<tr>
<td>PHYS</td>
<td>88 ± 22‡</td>
<td>67 ± 29</td>
<td>69 ± 21</td>
</tr>
<tr>
<td>SCD</td>
<td>59 ± 41</td>
<td>57 ± 36</td>
<td>73 ± 37</td>
</tr>
</tbody>
</table>

Data are percent ± SD. P < 0.05

Left uterine displacement (LUD)
Standard ACLS algorithm (ACLS)
Physiologic changes of pregnancy (PHYS)
Recommendation to perform cesarean delivery in most parturient after 4-5 min of unsuccessful resuscitation for cardiac arrest (Stat CD)

Pregnancy and Cardiac Arrest

1:12,000 Delivery in US
60% Survival to Discharge

- BMV may NOT be effective
- Intubate or LTA/Combitube (LMA probably less effective based on TLC)
- Cricothyrotomy EARLY
- Your baseline is 15% pulmonary absolute shunt
- Compress slightly above the midsternum

- Get your Team READY for C/S within a 3-30 minutes rule
  - 15 weeks both can survive without it
  - 15-25 weeks gap of knowledge
  - 24 weeks baby survives only on a 5 min C/S rule
  - >30 weeks baby survives up to 30 minutes C/S rule

Resuscitation the the Pregnant Patient... Gaps in Critical Knowledge

Circulation 2010;122: S829-S861

Pregnancy and CA in US

Circulation 2010;122: S829-S861
• Pre-existing pulmonary hypertension
• Mg Toxicity
• Eclampsia
  • Baby Out NOW!
  • Blood!
• PE
  • TEE and tPA
  • Heroic CPB surgery justified
• Amniotic Fluid embolism
  • TEE
  • Baby OUT
  • Early ECMO Support

Consider the Hypothermia Equation:
[If no C/S needed post ROSC (Mother and baby) and Mom in Coma] = Hypothermia

Prolonged QT
- Beta blockade
- TCAs
- Neuroleptics
- Propofol
- Opioids
- Anti-delirium
- Abx
  • macrolide and quinolone, antifungal
  • Class III and IV anti-dysrhythmic
  • Prokinetic

- Mg Toxicity

Pulmonary Hypertension: Bad News for CPR Success

How Long Can We Provide CPR in the OR
(AHA suggests 3 Cycles of Drugs CPR)

Of Course The Italians..
Yes We Can..

Special Logistics in the OR imply the need for loooong time of CPR

The Future is Here

New Gadgets

ECMO

Post ROSC Hypothermia

A Brain Under Anesthesia Has Low CMRO$_2$

Mechanical vs Manual CPR

Rise of the CPR Machine?

Inspiratory Threshold Device:

AHA 2010 IIb Level Recommendation

Westfall CCM 2013;41:1782-1789

No resistance to exhalation
**Inspiratory Threshold Device:**
AHA 2010 IIb Level Recommendation

- No resistance to exhalation

**Why I Believe in this Technique..**

* Aufderheide Lancet 2011 Jan 22;377(9762):301-11

**Cardiac Arrest in the OR:**
Should We Attempt to Wake the Patient up?
Depends How Long Was the Arrest

* Weisfeld and Becker, JAMA 2002

**ECMO CPR**

**IHCA: Worse outcome**
- Length of CPR >35 min
- AKI requiring dialysis
- Not shockable rhythm

**OHCA: Save-J Study Group**
- ECMO+IABP
- CPC ½ score better in E-CPR 10:1

* Sakamoto T
Resuscitation 2014 in press

**Do Not Argue About Hypothermia**
What About in the OR?

- Persistent hypotension? No
- Arrhythmia? No (provided temp stays >30°C)
- Pregnancy? No
- Severe pre-admission morbidity? No
- Age? No
- Need for PCI? No
- Active bleeding? Take care of it quickly, but use common sense for contraindications.
- Reverse your anesthetic to assess neurological status? Probably no.
- You have 4 hours time to get things organized.

**NEJM 2013;369:2197-06**

- Large study (950 pts)
- 20% non shockable pts
- Fever avoided X 3 days after rewarming
In Conclusion..

We Came a Long Way from the Times of “Annie Annie Are You Ok?”

The Basic of resuscitation is Chest compression. Goals should include ETCO2 and DBP

Think CPR focused to A-ACLS logistics:

People, Tools, Environment and Logistics are different.

The OR Chain of Survival in the OR has a Different Perspective