Time to Defibrillation…
What Can We Do to Improve Shock Success?

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Objectives

• Review the 2010 American Heart Association Guidelines
• Describe physiologic changes associated with ventricular fibrillation
• Discuss the benefit of biphasic shocks for successful conversion of ventricular fibrillation
Chances of surviving an In-Hospital Cardiac Arrest?

Most common In-Hospital Arrest?

- Asystole
- PEA
- Vfib/Pulseless VT
Asystole & PEA make up 67% of all adult In-Hospital cardiac arrests

Circulation (2013); Morrison, et al.

2010 AHA Guidelines for V-fib Arrest
The purpose of defibrillation...

- To briefly terminate all electrical activity
- It does not restart the heart!!!
- Pacemakers of the heart will resume electrical activity

- Why continue chest compressions after shock?

- Initial post-shock rhythm is often slow
- Inadequate cardiac output & perfusion

Monophasic vs. Biphasic
Biphasic Waveform?

• Biphasic is the standard of care

Fibrillating Heart
Comparing Mono & Biphasic

- Electrophysiology Lab
- Induced VF 115 patients prior to ICD placement

<table>
<thead>
<tr>
<th>Table 3. First-shock Efficacy for First Episode of Ventricular Fibrillation in Each Patient</th>
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<tbody>
<tr>
<td>Group</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>200-J monophasic</td>
</tr>
<tr>
<td><strong>200-J biphasic</strong></td>
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<tr>
<td>130-J biphasic</td>
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Post Shock Rhythm

<table>
<thead>
<tr>
<th>Table 4. Rhythms Present after Successful First Shocks, Expressed as Percentages of the Number of Successes for Each Shock Type</th>
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<tbody>
<tr>
<td>Rhythm</td>
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<tr>
<td>-------------------------------------</td>
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<tr>
<td>Normal sinus rhythm</td>
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<tr>
<td>Sinus bradycardia</td>
</tr>
<tr>
<td>Sinus tachycardia</td>
</tr>
<tr>
<td>Supraventricular tachycardia (not sinus)</td>
</tr>
<tr>
<td>Idioventricular</td>
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<tr>
<td>Paced</td>
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<tr>
<td>Junctional</td>
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<tr>
<td>Other</td>
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Stiell: The Benefit of Higher Energy Regimens

Among patients requiring more than 1 shock, the escalating higher energy regimen provided a significantly higher rate of VF termination.

Stiell et al, Circulation 2007;115:1511-1517

Escalating energy for Vfib!

- Energy varies by manufacturer recommendation
- Physio-Control Biphasic
  - 200 joules – 1st shock
  - 300 joules – 2nd shock
  - 360 joules – all following shocks
- Monophasic
  - 360 joules – all shocks
Transthoracic Impedance?

- What affects it?
  - Barrel chest
  - Dry skin
  - Metabolic abnormalities
  - Duration of arrhythmia prior to shock
  - Myocardial ischemia

- 70 – 90 ohms Normal
- > 100 ohms Increased impedance
- > 150 ohms Very high impedance

When to shock?

- Earlier is better – UNDER 3 MINUTES!!!
- We know survival decreases over time
- For every minute that passes, survival drops from 7-10% if no compressions are provided
- With compressions, the decline is 3-4% per minute
  - Vfib often deteriorates to asystole

- Shock early, but when?
- Compressions to off-load the right ventricle & provide forward flow to the left ventricle?
- (Class IIb, LOE B)
Vfib

Steen et al. Resuscitation. 2003; 58: 249-258

5min in 10s

6½ min VF without Compressions

Steen et al. Resuscitation. 2003; 58: 249-258
Decreasing time to defibrillation?

- Analyze the rhythm quickly, do not waste time!
- Have the defibrillator charged and ready to go before the end of the 2 minute compression cycle
- Performing CPR while a defibrillator is readied for use is strongly recommended for all patients in cardiac arrest (Class I, LOE B)
- Compressions will deliver oxygen to the heart likely increasing the likelihood of shock success
Minimize Pre and Post Shock Pauses

- Review system data and adjust energy levels
- Post event review with feedback and training to the team
- Use mechanical CPR to minimize pauses
- Charge the defibrillator while doing CPR
  - Briefly check rhythm, stand clear and shock
  - **Immediately** resume CPR

Defibrillation in non-tele areas?

- Consider AEDs
- Manual defibrillators in AED mode
- **Focus training on BLS:**
  - Compressions
  - Defibrillation
  - Airway/ventilation
Paddles vs. Pads

- Self-adhesive pads recommended by AHA
- Conduction medium is essential!
- Pads reduce risk & allow for monitoring
- Rapid delivery of shock
Pad Placement

- Anterior/Lateral
- Anterior/Posterior
  - Anterior/Left Infrascapular
  - Anterior/Right Infrascapular

Special Circumstances

- Hairy chest
- Chest wetness
  - Wipe off chest
- Transdermal Medication patches
  - Do not place on top of patches
  - May block energy
  - Skin burn
- Implantable Pacemaker/defibrillator
  - Not a contraindication!
  - Do not place pad on top of internal PM/ICD
  - Allow 30-60 seconds for the ICD to complete treatment cycle before shocking with an external device
Do drugs help?

- Epinephrine 1 mg IV/IO every 3-5 min
  - A-adrenergic effects
  - Escalating and high dose did not improve survival

- Vasopressin 40 units IV/IO x 1
  - Non-adrenergic peripheral vasoconstrictor
  - Use in place of 1st or 2nd Epi
  - No survival difference vs. Epi

Anti-arrhythmics

- Amiodorone
  - 300 mg IV/IO; repeat with 150 mg

- Lidocaine
  - 1 – 1.5 mg/kg IV/IO, then 0.5 – 0.75 mg/kg IV to a max of 3 mg/kg

- Magnesium Sulfate
  - Only for Torsades de Pointes
  - 1 – 2 Grams IV/IO

- ALP Study – King County
  - Amio vs. Lido vs. Placebo
What’s the cause?

5 H’s
- H+ (Acidosis)
- Hyper/Hypokalemia
- Hypovolemia
- Severe hypothermia
- Hypoxia

5 T’s
- Toxins
- Tension pneumothorax
- Tamponade
- Thrombus – PE
- Thrombus – MI

Post-Arrest Care

- Treat causes
  - STEMI/AMI
  - PCI
- Hemodynamics
  - Treat hypotension
- Monitor for re-arrest
- EtCO₂/waveform capnography
- Therapeutic Hypothermia
Training

- Know how to use your equipment!
- Training
- Mock codes
- Simulation
- Skills day training
- Crash cart checks to increase familiarity
- Designated person to deliver shocks?

In conclusion:

- Do not delay compressions!
- Minimize interruptions in compressions
- Defibrillate in less than 3 minutes
- Escalate energy to improve shock success
- Provide post-arrest care
- Training is essential
- Know your stats!