Lay Provider Care

What’s all the fuss about this lay provider care? Why not just take them to the hospital ASAP?
Survival in Cardiac Arrest

**Time to Therapy is Key**

- Early intervention
- Chest compressions
- Defibrillation
- Particularly in cardiogenic cardiac arrest
- ER…EMS….Bystander & Lay Provider

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**Community Notification**

- Smartphone-based technology
- Operated by 911 centers
- Intent
  - Reduce time to compressions
  - Reduce time to AED
- Largely endorsed by public safety agencies
- No EMS-based complaints

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**Bystander CPR**

**Early CPR Increases Survival**

- Compressions vs ventilations vs both
  - Compression-only similar to superior
- Some form is highly important
- Reasonable to use compression-only
- Outcome altering
  - Survival rate increased
  - Improved neurologic outcome increased
**Bystander CPR**

<table>
<thead>
<tr>
<th>Study</th>
<th>Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard basic life support vs. continuous chest compressions only in out-of-hospital cardiac arrest</td>
<td>None 2.5%, CPR 4.3%, OD 1.72</td>
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<td>Chest Compression-Only CPR by Lay Rescuers and Survival from Out-of-Hospital Cardiac Arrest</td>
<td>CPR 10-15%</td>
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<td>Difference in Hemodynamic and Survival Outcomes for Patients With Out-of-Hospital Cardiac Arrest Treated by Lay Rescuers With Chest-Compression-Only CPR</td>
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<td>Cardiopulmonary resuscitation by bystanders with chest compression only (CPR-SHOCK) vs. standard CPR</td>
<td>OD 5.0 – 5.4</td>
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<td>Impact of various emergency medical services (EMS) responses on outcomes in out-of-hospital cardiac arrest</td>
<td>None 2.2%, CPR 5.2%</td>
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**Automatic External Defibrillator**

- Easy & safe
- Reduce time to defibrillation
- Used with CPR
- Can be life saving
- Obviously...only impact "shockable rhythm" presentations

**Automatic External Defibrillator**

**Early Studies**

- Airports, gambling casinos, & general community
- Greatly reduced time to 1st shock
- Improved outcome

**Comparing EMS vs Bystander AED Shock**

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<td>Impact of Onsite or Dispatched Automated External Defibrillator Use on Survival After Cardiac Arrest</td>
<td>EMS 31%, Bystander 45%, Bystander AED 1.62 OR</td>
</tr>
<tr>
<td>Survival after Public Access Defibrillation in Stockholm, Sweden – A model success</td>
<td>EMS 31%, First Responder 42%, Bystander 70%</td>
</tr>
<tr>
<td>Public access defibrillation – Results from the Victorian Ambulance Cardiac Arrest Registry</td>
<td>None 9%, Bystander 38%, Bystander AED 1.75 OR</td>
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**AEDs...They work when you use them!**

**AEDs are used infrequently by lay providers**

**Survival in Cardiac Arrest**

*Time to Therapy is Key*
Lay Provider Care

- Social media to alert lay providers of near-by cardiac arrest
- Bystander CPR, preferably compression-only
- Automatic external defibrillator use
- ...and Dispatcher, pre-arrival CPR instructions

The “Code” Meds

None of the meds ever work! Giving any of them is a big waste of time!! So why do YOU do it?

Antiarrhythmic for VF/pVT

- Amiodarone may be considered
- Lidocaine may be considered as alternative
- Magnesium not recommended

“No antiarrhythmic as yet been shown to increase survival or neurologic outcome after cardiac arrest due to VF/pVT”

What is the best antiarrhythmic for shock resistant VF/pVT: Amiodarone vs Lidocaine vs Placebo?

- 3,026 pts., 10 ROC sites
- Randomized, double blind, placebo controlled
- VF/pVT, s/p 1 or more shocks, s/p epi
- Only adult, medical VF/pVT OOH
Percentage Differences

- Amiodarone vs Placebo: 3.2% (p=0.08)
- Amiodarone vs Lidocaine: 0.7% (p=0.70)
- Lidocaine vs Placebo: 2.6% (p=0.16)
- Amiodarone vs Placebo Modified Rankin ≤ 3: 2.2% (p=0.19)
- Amiodarone vs Lidocaine Modified Rankin ≤ 3: 1.3% (p=0.44)

Results

Amiodarone vs Placebo:
- ↑ trend for hospital discharge with Amio (p=0.08)
- No difference in favorable neuro outcomes

Lidocaine vs Placebo:
- No significant difference at discharge

Amiodarone vs Lidocaine:
- No difference in hospital discharge (p=0.81)

What do all studies combined tell us about Amiodarone vs Lidocaine in VF/pVT?
- 7 studies: 3 RCTs, 4 non-RCTs
- 3,877 pts in RCTs and 700 in non-RCTs
- Includes 2016 NEJM trial
- Admission and Discharged Alive evaluated

At the present time, there is no clear benefit of Amiodarone vs Lidocaine

Late inVF it’s not clear either drug is beneficial

Authors Note in Letter to Editor

- 5% absolute improvement of Amiodarone over placebo (p ≤ 0.04) if arrest witnessed (1934 pts)
- 21.9% absolute increase Amiodarone vs placebo if EMS witnessed and gave drugs near immediately (p < 0.01 for 154 pts)

Do not always use pre-hospital data for in-ED and in-hospital arrests
Corey, so there is limited to no benefit for med administration.

Is there anything other than amiodarone or lidocaine for refractory VF?

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**Refractory VF**

- Switching pad locations
- Beta blockers
- Double sequential defibrillation
- ECMO/ECLS (discussed later…)

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**Refractory VF/pVT**

**Change Pad Location**

Ant-Lat ↔ Ant-Post

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**Beta Blockers**

- Use not addressed during VF/pVT
- “Inadequate evidence” to support post CPR use
- May be considered
- Not enough evidence to be for or against lidocaine or beta blockers s/p VF/pVT

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**Esmolol for Refractory VF/VT**

Sustained ROSC and Good Neuro D/C

- Retrospective ED study
- All EMS to ED arrivals
- All s/p 3 shocks, 3 doses Epi, 300mg Amio
- Compares Esmolol vs no Esmolol
I now always consider beta blockers in VF

Double Sequential Defibrillation

Take Homes

- Not a randomized trial
- Many pts got up to 10 shocks pre DSD
- The role of Double Sequential Defibrillation is not yet clarified and needs a randomized larger trial

Treating VF/pVT

Take Homes

- Either Lidocaine or Amiodarone, not ready to drop antiarrhythmics completely in VF/pVT
- They work if given immediately
- Consider Beta Blockers in shock resistant refractory VF
- Consider moving pads
- Consider double sequential defibrillation

Is double sequential defibrillation (DSD) beneficial in refractory VF/pVT?

- 45 patients treated with DSD
- Retrospective observational study
- London Ambulance Service
- Compared to 175 who got standard defibrillation
- Only patients with ≥ 6 shocks compared

Standard vs DSD in VF/pVT

<table>
<thead>
<tr>
<th></th>
<th>EMS ROSC</th>
<th>Hosp ROSC</th>
<th>Discharged</th>
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<tbody>
<tr>
<td>STD</td>
<td>56%</td>
<td>35%</td>
<td>7%</td>
</tr>
<tr>
<td>DSD</td>
<td>59%</td>
<td>38%</td>
<td>7%</td>
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Treating VF pVT

- Either Lidocaine or Amiodarone, not ready to drop antiarrhythmics completely in VF/pVT
- They work if given immediately
- Consider Beta Blockers in shock resistant refractory VF
- Consider moving pads
- Consider double sequential defibrillation
Corey, anything new on epi? Should we still use it?

Epinephrine Use

Standard dose epinephrine (1 mg Q 3-5 min) may be reasonable for patients with cardiac arrest (class Iib)

- Early administration may improve ROSC and neurologic outcomes – later administration may decrease both

Does Epinephrine use have true benefits in CPR?

- Meta analysis, 14 RCTs, 12,246 patients
- Studies were:
  - Epi vs placebo (1) n = 534
  - Epi vs high does Epi (6) n = 6,174
  - Epi vs Vasopression (1) n = 336
  - Epi vs Epi + Vasopressin (6) n = 5,202

NO!!

Asystole

Survival and Good Neuro Outcomes

Epinephrine vs No Epinephrine

- Japanese national database 2008-2012
- Used propensity matched pairs of patients
- 8,906 AS* paired and 7,451 pairs in PEA*
- Used time to epi, age and severity to pair
- Evaluated both survival and good neuro

*Only bystander witnessed arrests
**PEA**

**Survival and Good Neuro Outcomes**

Epinephrine vs No Epinephrine

- **Survival**
  - 2.38% Epi vs 1.00% No Epi
  - OR = 2.34
  - CI > 95%

- **Good Neuro**
  - 2.22% Epi vs 0.22% No Epi
  - OR = 2.28
  - CI > 95%

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**Epinephrine Dosing Intervals (min)**

**Adjusted Odds Ratio for Survival**

- 1-3 min:
  - 1.70

- 3-4 min:
  - 1.51

- 4-5 min:
  - 1.79

- 5-6 min:
  - 2.17

- 6-7 min:
  - 1.96

- 7-8 min:
  - 1.41

- 8-9 min:
  - 1.30

- 9-10 min:
  - 2.67

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**Epinephrine Dosing Interval Take Homes**

- Although ACLS guideline say Q 3-5, it appears that spacing epinephrine doses out to up to 8-10 minutes may be optimal

- This is a violation of current guidelines

- No randomized study exists

- Give less not more
Does giving epinephrine before 2nd shock help or hinder resuscitation?

- 2,974 VF/pVT arrests, 1,510 with epi < 2 min
- Inpatient data from 300 GWTG-R hospitals
- Propensity matched cardiac arrest pts
- 51% of patients received epi before 2nd shock

Epi Before vs After 2nd Shock

Wait for second shock before giving Epi in VF!

Summary of Epi in CPR

Take Homes

- Epinephrine's role in CPR still not clear
- Give early in non-VF arrest to optimize good outcome
- ROSC and good neuro outcomes are improved when epi is given earlier vs later in CPR
- Wait for 2nd shock for epi in VF/pVT
- Give less not more as arrest progresses

Airway Management
Intubation is very important. Everyone in cardiac arrest should be intubated ASAP.

**Airway Management**

- Prior teaching...Focused on the “ABC’s”
  - Favored ETT...early & in all
- Alphabet no longer starts with “A”...The “CAB’s”
  - Cardiogenic vs non-cardiogenic
- Cardiogenic - Sudden with oxygen “reserve” & little acidosis
  - “Less early” airway
- Non-cardiogenic - Gradual with progressive hypoxia & acidosis
  - Earlier airway

**Airway Management**

- Placement of Invasive Airway
  - Survival was higher ...for patients who received no advanced airway...
  - when compared to BVM ventilation, advanced airways were associated with decreased survival to hospital discharge...
  - individuals most likely to have ROSC & survival to hospital discharge were those who did not have a reported ETI attempt…

- No increase in ROSC but a minimal increase in 24 hr survival which was not sustained…

**Airway Management**

- Management Basic vs Advanced Care
  - In both populations, advanced care had marginal positive impact on outcome…
Compression Interruptions

- *Resuscitatus interruptus*
- Negatively impacts outcome
- Without compressions, no perfusion is occurring
- Airway management accounts for longest interruption
- Basic vs advanced care impact

Compression Interruptions
Due to Endotracheal Intubation

Interruptions are significant & negatively impact outcome

Airway Management

- Shockable vs non-shockable rhythms
- Early vs late airway management
- Invasive vs BVM
- Avoid interruptions, particularly early, due to airway management

Post-Resuscitation Care

Post-resuscitation care should only include BP & airway management. The rest of those interventions really are not of value in most patients & should be done in the ICU.

2017 ACC/AHA Guidelines
PCI and Hypothermia

- Therapeutic hypothermia should be started ASAP for all comatose STEMI patients and out of hospital arrests due to VF or VT (1B)
- Immediate PCI is indicated in all STEMI arrest patients including those who are receiving therapeutic hypothermia (1B)
(32° - 34°) Therapeutic Hypothermia significantly improves survival (↑26%) and neurologic outcome (140%) after VF/pVT cardiac arrest

Hypothermia vs Normal Temp
Survival and Neuro Outcomes


Therapeutic Hypothermia
Take Homes

• The future of deep TH is unclear
• Preventing Hyperthermia appears crucial
• Future studies will determine optimal TH temp
• Well done study, but likely not the final study
• 35° – 36° looks like the new 32° – 34°

Is ECMO really of value in patients with ongoing cardiac arrest?

…who are the patients?
…what are the system
Does ECMO have a role in CPR?

**ECMO**

- Mechanical CPR
- Therapeutic Hypothermia
- Immediate post ECMO PCI
- 24 hours of TH

**E-CPR** ‘ECLS’

- ECMO
- Mechanical CPR
- Therapeutic Hypothermia
- Immediate post ECMO PCI
- 24 hours of TH

Uses of ECMO and ECLS

- Respiratory failure – ARDS, H1N1, SARS
- Bridge to heart transplant
- Bridge to lung transplant
- Cardiogenic shock
- ECLS s/p cardiac arrest

Does ECMO improve post-arrest resuscitation outcomes – The CHEER trial

- Refractory VF x 30 minutes
- No known underlying severe disease
- CPR within 10 minutes of arrest
- Mechanical CPR available
- ECMO Team with 2 MDs present
E-CPR Results

- 26 patients (11 OHCA, 15 IHCA)
- ECMO within 56 minutes; 2 days on
- 96% ROSC

54% (14/26) survived to discharge with CPC score of 1 – full neurologic recovery

ECPR

- Shockable arrest rhythm or known precipitant
- Reversible cause of arrest
- Witnessed arrest with CPR
- Duration of pulselessness < 15-20 min or transient ROSC
- Absence of major life-limiting comorbidities

No ECPR

- Elderly or serious underlying diseases
- Irreversible neurologic insult
- Morbid obesity or arterial disease
- ECLS team not readily available
- Contraindications to LVAD, Heart Transplant

Survival Improvement with ECLS (CPC 1-2)

- Chen 2008  ↑2.3 x (12.3 vs 28.8)
- Shin 2011  ↑3.6 x (7.8 vs 28.2)
- Meekawa 2013  ↑5.0 x (6.4 vs 32.1)
- Sakamoto 2014  ↑8.2 x (1.5 vs 12.3)

ECLS clearly improves in-hospital arrest outcomes if begun within 30-60 minutes of arrest

ECLS of variable benefit for out of hospital arrests unless transported rapidly to the ED

- Rapid ECLS for VF/pVT
- ECLS s/p 3 shocks + amio in 18 pts
- 911 to CCL 60 min + 6 min for ECMO
- No significant complications
- 50% good neuro outcomes 9/18
Bill, this is my last question… What are your thoughts on PCI post arrest?

This is not a new thing!

**STEMI After ROSC**

Fibrinolysis or PCI +/- Hypothermia

"Survival at 6 months was 54% with 46% demonstrating good neurologic function"  
"...initially comatose patients survived 51% of hospitalizations with good neurological status in 29%"  
"...55% of the TH group compared to non-TH group were discharged with good neurological outcome"

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STEMI After ROSC

- Prehospital cardiac arrest -- #714 survivors (Paris)
- Retrospective review
- Immediate PCI in ST elevation & non-ST elevation cases

714 survivors, 205 excluded (non-cardiac)

- 435 to catheterization
- 126 with at least 1 lesion
- 74% with PCI, 54% survival
- 217 no ST elevation
- 126 with at least 1 lesion
- 88% with PCI, 57% survival

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Is PCI indicated s/p VF/pVT arrests if no STEMI on 12-lead?

- Systematic review and meta-analysis
- 11 articles involving 2,885 pts.
- STEMI pts 13 x for transport to CCL
- Evaluated "STEMI" in CCL if no STEMI on ECG

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- 71.9% of STEMI on ECG pts had an acute culprit lesion
- 32.2% of "non-STEMI" ECG pts had an acute culprit lesion
Immediate CCL s/p VF/pVT Arrest

• Improves survival by a factor of 3.7 (CI 1.31-10.70) regardless of STEMI or no STEMI on ECG

• ↑ survival by 30% if no STEMI on ECG

VF/pVT Arrests on CCL

• Not a randomized trial
• Potential referral bias
• Another in a series of studies
• All show CCL improves survival
• All show up to 30% of "no STEMI" is a STEMI
• Go to the lab!

Resuscitation 2016;108:54-60

Take Homes

• Not a randomized trial
• Potential referral bias
• Another in a series of studies
• All show CCL improves survival
• All show up to 30% of "no STEMI" is a STEMI
• Go to the lab!

How common is an intervenable coronary lesion in pts who obtain ROSC s/p arrest from a non-shockable rhythm?

• 1,396 ROSC pts, 18 centers, retrospective review
• 879 of ROSC pts had AS or PEA
• 141 underwent angiography
• 31% (44 / 141) had STEMI

97 patients who obtained ROSC s/p AS or PEA went to angiography even though no ST elevation on post-ROSC ECG

Incidence of Intervenable Lesion at PCI s/p ROSC AS or PEA – No STEMI on ECG

STEMI Management after ROSC

JACC 2015;66:63

Interventional Council ACC
STEMI Management after ROSC

JACC 2015;66:63
Interventional Council ACC

In summary...

• Early care is vital...hospital, EMS & lay provider
• The “code meds” – niche application
• Airway management
  – Shockable vs non-shockable rhythms
  – Early vs non early
  – Interruptions...
• Post-ROSC care
  – Basic is key
  – Advanced in certain patients – PCI, TTM, & ECMO

STEMI After ROSC

• Greatest benefit in STEMI with VT/VF
• s/p VT/VF without STEMI also benefits
• Potential benefit in AS/PEA, if cardiogenic...
• STEMI NOT REQUIRED to identify PCI candidates

The bottom line you ask...

• One approach does not fit all resuscitation events
• Tailor your approach to your patient & the individual scenario
That’s it…thanks!

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