Connecting EMS, Hospitals, and Community

LEONARD S. WEISS, MD
UNIVERSITY OF PITTSBURGH

Presenter Disclosure Information
Leonard S. Weiss, MD
Community, Hospital, EMS in Cardiac Arrest

FINANCIAL DISCLOSURE:
No relevant financial relationship exists
Effective Cardiac Arrest Care...

...is a SYSTEM of treatment
Goal

Interconnect:

Community
EMS
Hospital

“Cardiac Resuscitation Center?”

Insufficient resources for acute cardiac care

No true way to define a “center”

Experts aligned OHCA care with STEMI care

OHCA → transport to 24/7 PCI Facility
So, what to do after ROSC?

Think about:

- Transport to Resuscitation Center
- Components of Specialized Care

Resuscitation Centers

**LEVEL 1 (RECEIVING)**
- Ideal STEMI receiving center (24/7 PCI)
- Work with EMS/Referral centers to develop plan
- Initiate hypothermia asap when indicated
- Universal 24 h/d, 7d/w acceptance w/o diversion
- Cardiology + OTHERS involvement asap
- Defer neuro prognostication for 72 hrs
- Assess ICD need, placement, follow-up
- Treat simultaneous patients
- Treat re-arrest

**LEVEL 2 (REFERRING)**
- Ideal STEMI referring center (no 24/7 PPCI)
- Maintain plans with EMS to ensure priority transfer
- Initiate hypothermia asap when indicated
- Transfer ROSC within 120 minutes door-to-device
- Treat re-arrest
Local Implementation

LA County
- Already had Regionalized STEMI System
- Transport OHCA with shockable rhythm to STEMI Center
- Therapeutic hypothermia
- This in addition to bystander CPR, early defibrillation access, prolonged field resus efforts
- Improved CPC 1 or 2 from 6% to 40%

Statewide Implementation

Arizona, 2007
- State Recognized Cardiac Arrest Receiving Centers
- Focus on therapeutic hypothermia, emergency PCI, delayed prognostication of neuro status
- EMS bypass protocol for OHCA + ROSC ➔ nearest center

Overall Survival= 21.4% ➔ 39.2%
CPC 1 or 2= 19.4% ➔ 29.8%
Components of Specialized Care

Targeted Temperature Management
- Goal has been between 32 °C and 36 °C
- No superiority between 33 °C and 36 °C
- < 32 °C is bad
- Hyperthermia is bad

- Now:
  36 °C for 24 hours in uncomplicated/moderate coma (with some motor response), no malignant EEG patterns, cerebral edema on CT scan
  32 °C for 24 hours with deep coma (no motor or brainstem response), malignant EEG patterns, CT suggestive of edema

Components of Specialized Care

Access to PCI
- 70% OHCA patients have CAD
- Up to 50% have coronary occlusion
  - Even though many without ST-elevations on EKG

- Challenge:
  - STEMI metrics, doctors, hospitals want good outcomes
  - OHCA-ROSC patient is already a challenge and may need PCI, but less guarantee for good outcome

Need to secure recommendations for appropriate use and outcomes reporting of PCI in the OHCA-ROSC patient
Components of Specialized Care

Prognostication and Neuro Critical Care
- Wait
  - 72 hours after return to normothermia if TTM
  - 72 hours after ROSC if no TTM
- Avoid premature conclusions or withdrawal of care
- Continuous EEG monitoring
  - Prognosis
  - Treat seizures
  - Monitor and help the Brain
- Sedation
  - Propofol + Fentanyl
  - Midazolam
  - Dexmedetomidine

In the Field

Target End-tidal CO2 around 35-45
- Avoid hyperventilation
- Decreases CO2 $\rightarrow$ cerebral vasoconstriction $\rightarrow$ damage

Ensure adequate oxygenation
- SpO2 greater than 94%
  - Hypoxia $\rightarrow$ damage
  - Avoid 100% or hyperoxia $\rightarrow$ damage

In the Field

Hypotension or Hypoperfusion = BAD $\rightarrow$ damage

Goal Mean Aterial Pressure (MAP) above 65 mmHg
Prefer 80-100 mmHg to maximize cerebral perfusion

IV Fluids as needed
Vasopressors as needed (Norepinephrine and Epinephrine)
- Dopamine
### Key Post Arrest Interventions:

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Performed</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airway Secured</td>
<td>N/A</td>
<td>No advanced airway – pt combative</td>
</tr>
<tr>
<td>2 EtCO2 readings documented</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>2 Blood Pressures documented</td>
<td>YES</td>
<td>90 &amp; 90/SYS</td>
</tr>
<tr>
<td>Fluid Bolus</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Epinephrine Drip</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>12 Lead EKG</td>
<td>YES</td>
<td>STEMI</td>
</tr>
<tr>
<td>Glucose</td>
<td>NO</td>
<td></td>
</tr>
</tbody>
</table>
Future Concepts...

...SYSTEMS AND TECHNOLOGY

The future of EMS and Acute Care...

...It will entail more integrated or regionalized systems of care in a variety of ways
The future of EMS and Acute Care...

... **integrated** or **regionalized** systems of care
Regionalized Systems of Care

[Diagram showing an ambulance transporting a patient with a heart symbol to a hospital, labeled 'ROSC'.]

Regionalized Systems of Care

[Diagram showing an ambulance transporting a patient with a heart symbol, a helicopter, and a hospital, all labeled 'ROSC'.]
Regionalized Systems of Care

Safe to transport?

Included (n=248)
Cardiac (n=231)
Overdose (n=15)
Airway Obstruction (n=2)

Re-Arrest Enroute (n=15) (6%)
Critical Event (N=58) (24%)
No Event Enroute (n=175) (71%)

Hartke 2010; Resuscitation 81(8):938-42
ECPR for Out of Hospital Cardiac Arrest

Emergency Cardio-Pulmonary Bypass (ECPB)

- Extra-Corporeal Life Support (ECLS)
  - Veno-Arterial Extracorporeal Membrane Oxygenation (VA-ECMO)
- Extra-Corporeal CPR (ECPR or eCPR)
  = CPR + ECLS until ROSC or circuit on

NOT:
- Veno-Venous Extra-Corporeal Membrane Oxygenation (VV-ECMO)
Basic Concept

- **Veno-Arterial (VA)**
  - blood drawn from venous system
  - returned to arterial system
  - CARDIAC & PULMONARY support
  - central or peripheral cannulation

- **Veno-Venous (VV)**
  - blood drawn from venous system
  - returned to venous system
  - PULMONARY support only

---

University of Pittsburgh & Pittsburgh EMS
Prehospital ECPR Checklist:

- [ ] Witnessed arrest
- [ ] Bystander CPR
- [ ] Age ≥ 18 and ≤ 60
- [ ] Initial shockable rhythm or PEA rate > 20 bpm
- [ ] Good functional status prior to arrest (patient living independently and not from a skilled nursing facility/ LTAC and no prior neurocognitive dysfunction)
- [ ] No signs of irreversible organ dysfunction (such as COPD on home O2, stigmata of liver cirrhosis or ESRD such as AV fistula or terminal cancer)
- [ ] No morbid obesity (Morbid obesity defined as inability to fit into LUCAS device and/or abdominal pannus overhanging inguinal crease)
- [ ] End tidal CO2 >10 mmHg with CPR
- [ ] Expected time from collapse to ED arrival ≤ 30 mins
PulsePoint

1. Call for Help
   - Ensure the area is safe before approaching.
   - If possible, seek assistance or call 911.
   - If the victim is not breathing or not breathing normally, call 911 and return to the victim.

2. Begin Chest Compressions
   - Place your hands in the center of the chest, between the nipples.
   - Push hard and fast, at least 100 compressions per minute, until help arrives.
   - If chest compressions become difficult, try pushing down with your body weight.

Standard Bystander CPR

Patient

Effective Radius: Shouting Distance

Shouting Distance
Dispatch-Connected Bystander CPR

Patient

Effective Radius:
Walking Distance
Let’s Connect
EMS, Hospitals, Community

Layperson CPR + AED → legislation → CPR in Schools →
911 instructions → real-time location data →
EMS response → high-quality care →
destination protocols → network of appropriate
referral and receiving hospitals →
specialization, QI, data and outcomes measurement

= SYSTEM