Out-of-Hospital Cardiac Arrest In North Carolina

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Regional Approach to Cardiovascular Emergencies
Disclosure

Research funding from Medtronic Foundation, Medicines Company, Philips Healthcare, Abiomed
STEMI Systems Coverage

As of 6/21/2012 (630 Systems; 62.7% Population Coverage)
STEMI Accelerator

Individual hospital

Hub and spoke model

Regional system

Journal of Invasive Cardiology 2011; 23 A:8-12
STEMI Accelerator

STEMI Accelerator Sites
Improving SCA Survival by 50% in 5 years in North Carolina

1: **Bystander Response**
- Recognize SCA
- Early 911
- Effective bystander CPR
- Public access to AED

2: **Pre-hospital Response**
- Enhanced dispatch
- Enhanced CPR
- Appropriate defibrillation therapy
- Early Advanced Care

3: **Hospital Response**
- Patient triage to Resus. Center of Excellence
- Hypothermia
- 24/7 Cath Lab
- ICD
- Post-survival patient education & support
**Cardiac Arrest**
- Unresponsive
- Not breathing normally

**Community**
- Hands Only CPR | Bystander CPR
- Early activation of 911
- Apply AED before EMS arrival

**EMS ON-SCENE**
- Minimize interruptions of CPR
- Encourage 12-lead ECG after ROSC
- Consider Destination Protocol

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**Receiving Hospital (PCI-capable)**
- Initiate hypothermia <6 hrs from onset of arrest
- Consider early PCI
- Defer Prognosis assessment for 3 days
- Consider need for ICD before discharge

**Referral Hospital (non PCI-capable)**
- Initiate hypothermia <6 hrs from onset of arrest
- Consider transfer to resuscitation receiving center if unconscious and hemodynamically stable

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**Interhospital transfer**

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**EMS Triage Plan**
• Goal - increase overall out-of-hospital cardiac arrest survival rates by 50% over five years

• Support community to state-wide initiatives that focus on a “systems-based” approach to out-of-hospital cardiac arrest
50 yo man felt ill on Aug 5 2012

He was hugging wife, who felt him become heavy and then collapse in her arms

She worked in home health and had learned CPR at work one month earlier

Started CPR, called 9-1-1

Paramedics applied 6 shocks for VFib

ECG obtained
HR 107 - STMT - * SINUS TACHYCARDIA (Now Present)
- STMT - * (Now Absent) ATRIAL FIBRILLATION
PR 148 - STMT - * RBBB AND LPFB (Remains)
QRSD 132 - STMT - * INFEROLATERAL ST ELEVATION, SUBEPICARDIAL INJURY (Remains)
QT 372 [SST] - * Suggest serial tracings, if clinically indicated
QTc 497 - REMK - * 2807817 tp

--- AXIS ---
P 51
QRS 120
T 27

PREVIOUS: 05-Aug-2012 19:57:25 - No Severity Confirmed

Order #: 666CH10012001
Reason: CHEST PAIN
Standard 12
Requested By: SERRA, RICHARD K

Confirmed by: Terry Fortin, M.D. 06-Aug-2012 12:50:49
- Taken immediately to cath lab, where 95% RCA found to have slow distal flow
- BMS placed; CK-MB 75; LV EF .35
- Prognosis declared grim since no corneal reflex on arrival to CCU
- Therapeutic hypothermia X 24 hours
Woke up on his 51st birthday (3 days after arrest)
We know what to do!

- Recognize arrest
- 9-1-1 with good dispatch
- Bystander CPR (high quality)
- Rapid EMS response (high quality CPR)
- Going to right hospital
- Primary PCI (for ST elevation)
- Therapeutic hypothermia
- Goal-directed intensive care
- Rehab and ICD
We know what to do!

- Recognize arrest
- 9-1-1 with good dispatch
- Bystander CPR (high quality)
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- Therapeutic hypothermia
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- Rehab and ICD
**RACE Cardiac Arrest Resuscitation System**

1) Develop leadership, funding, data structure

2) Establish REGIONAL **CARDIAC ARREST CENTERS**

3a) HOSPITAL by hospital establishment of **cardiac arrest** plan (review, consensus, training)

3b) EMS by EMS establishment of **cardiac arrest** plan (review, consensus, training)

3c) Community by community **cardiac arrest** training/AED placement

4) Improve system

**Measurement & Feedback**
“Humanity’s greatest advances are not in its discoveries – but in how those discoveries are applied ...”

Bill Gates, June 7, 2007

Harvard Commencement Address
"Many more people could survive cardiac arrest if regional systems of care were implemented"
Multifaceted Post-Cardiac Arrest Interventions (Including PPCI, hypothermia, intensive care)

% Survival with Cognitive Recovery*

Oddo  11  37
Sunde  26  56
Knafelj  19  53
Wolfrum  47  69
Galeski  22  40

* cpc 1 or 2

Nichols Circulation 2010;121;709-729
US Emergency Healthcare is Fragmented
118 emergency departments
540 EMS systems
21 primary PCI centers
5,240 paramedics
18,000 EMTs
118 emergency departments
Integrated, Systematic AMI Care
Reforming health care

This is going to hurt
Cardiovascular emergencies for which treatment benefit is time dependent

- STEMI
- Stroke
- Cardiac Arrest

Rathore BMJ 2009;338:1807
Regional Approach to Cardiovascular Emergencies
<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Level&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>All medical and paramedical personnel caring for a patient with suspected</td>
<td>Class I</td>
<td>Level C</td>
</tr>
<tr>
<td>myocardial infarction must have access to defibrillation equipment and be</td>
<td></td>
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<tr>
<td>trained in cardiac life support.</td>
<td></td>
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<tr>
<td>It is recommended to initiate ECG monitoring at the point of FMC in all</td>
<td>Class I</td>
<td>Level C</td>
</tr>
<tr>
<td>patients with suspected myocardial infarction.</td>
<td></td>
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</tr>
<tr>
<td>Therapeutic hypothermia is indicated early after resuscitation of cardiac</td>
<td>Class I</td>
<td>Level B</td>
</tr>
<tr>
<td>arrest patients who are comatose or in deep sedation.</td>
<td></td>
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<tr>
<td>Immediate angiography with a view to primary PCI is recommended in patients</td>
<td>Class I</td>
<td>Level B</td>
</tr>
<tr>
<td>with resuscitated cardiac arrest whose ECG shows STEMI.</td>
<td></td>
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</tr>
<tr>
<td>Immediate angiography with a view to primary PCI should be considered in</td>
<td>Class IIa</td>
<td>Level B</td>
</tr>
<tr>
<td>survivors of cardiac arrest without diagnostic ECG ST-segment elevation but</td>
<td></td>
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<tr>
<td>with a high suspicion of ongoing infarction.</td>
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</tbody>
</table>

ECG = electrocardiogram; FMC = first medical contact; PCI = percutaneous coronary intervention; STEMI = ST-segment elevation myocardial infarction.
If you don’t measure it, you can’t improve it
## Variation in Survival for Cardiac Arrest Resuscitations Outcomes Consortium

**Survival to Discharge for VF Arrest**

<table>
<thead>
<tr>
<th>Location</th>
<th>Survival Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vancouver</td>
<td>25.0%</td>
</tr>
<tr>
<td>Toronto</td>
<td>15.7%</td>
</tr>
<tr>
<td>Seattle</td>
<td>39.9%</td>
</tr>
<tr>
<td>Portland</td>
<td>22.5%</td>
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<tr>
<td>Pittsburgh</td>
<td>21.5%</td>
</tr>
<tr>
<td>Ottawa</td>
<td>14.8%</td>
</tr>
<tr>
<td>Milwaukee</td>
<td>26.0%</td>
</tr>
<tr>
<td>Iowa</td>
<td>22.7%</td>
</tr>
<tr>
<td>Dallas</td>
<td>9.5%</td>
</tr>
<tr>
<td>Alabama</td>
<td>7.7%</td>
</tr>
</tbody>
</table>

Nichol JAMA. 2008;300(12):1423-1431
<table>
<thead>
<tr>
<th>Cardiac Arrest Registry</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part A</strong>: Non-HealthEMS™ Users start here, otherwise skip to <strong>Part B</strong></td>
</tr>
<tr>
<td><strong>1. Street Address (Where Arrest Occurred)</strong></td>
</tr>
<tr>
<td><strong>1. City</strong></td>
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<tr>
<td><strong>2. First Name</strong></td>
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<tr>
<td><strong>4. Age</strong></td>
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<tr>
<td><strong>6. Gender</strong></td>
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<tr>
<td><strong>7. EMS Agency ID</strong></td>
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<tr>
<td><strong>10. Booklet ID (HealthEMS™ Users Only)</strong></td>
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<tr>
<td><strong>First Responding Agency</strong></td>
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<tr>
<td><strong>11. First/First Responder</strong></td>
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<tr>
<td><strong>13. EMS Notified</strong></td>
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<tr>
<td><strong>Arrest Information</strong></td>
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<td><strong>Resuscitation Information</strong></td>
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<td><strong>20. Who Initiated CPR</strong></td>
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</table>
Bystander Intervention (924)

AED %: 1.3% (12)
CPR %: 23.5% (217)

Cardiac Etiology Survival Rates

Overall: 11.8% (1096)
Bystander Wit'd: 18.7% (396)
Utstein: 31.7% (164)
Utstein Bystander: 28.7% (80)
EMS Witnessed: 19.8% (172)
Unwitnessed: 4.0% (528)
Shockable/Bystander: 41.4% (396)

Non-Cardiac Etiology 108

Unwitnessed Arrest 528
*see page 2

Initial Rhythm Asystole 107

No ROSC 68

ROSC in Field 38
ROSC in Hospital

Expired in Field 17
Expired in ED 14

Admitted to Hospital 22 (1 incomplete)

Discharged Alive 52

Discharged Alive 15

Neurological Status
CPC 1 or 2 48
CPC 3 or 4 3
Unknown = 0

Neurological Status
CPC 1 or 2 3
CPC 3 or 4 1
Unknown = 0
myCares.NET
powered bySansio

Reporting Systems
Reporting – only select agencies
Sites in progress
Future Sites

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>% Population</th>
<th>Cumulative Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMS Systems in NC</td>
<td>100</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>EMS Systems reporting into CARES</td>
<td>31</td>
<td>55.28%</td>
<td>55.28%</td>
</tr>
<tr>
<td>EMS Systems in Progress</td>
<td>14</td>
<td>12.94%</td>
<td>68.22%</td>
</tr>
<tr>
<td>Future EMS Systems</td>
<td>57</td>
<td>31.78%</td>
<td>100</td>
</tr>
</tbody>
</table>
Therapeutic Hypothermia
Hypothermia After Cardiac Arrest Study Group

- 275 patients VT/VF
- 5-15 minutes to initiation of resuscitation
- <60 minutes to restoration
- 24 hour temp 32-34 degrees
- 8 hours to achieve target temp

Cooling blankets, ice packs

<table>
<thead>
<tr>
<th></th>
<th>Hypothermia</th>
<th>Normothermia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Survival</strong></td>
<td>64%</td>
<td>50%</td>
</tr>
<tr>
<td>p=0.02</td>
<td>87/137</td>
<td>69/138</td>
</tr>
<tr>
<td><strong>Favorable neurologic outcome</strong></td>
<td>47%</td>
<td>31%</td>
</tr>
<tr>
<td>p=0.009</td>
<td>64/134</td>
<td>42/135</td>
</tr>
</tbody>
</table>

Survival and Neurologic Outcome at Discharge

Hypothermia After Cardiac Arrest Study Group

*N Engl J Med* 2002;346:549-56
Hypothermia

- Hypothermia saves lives

- Candidates
  - Persistent coma (not following commands) following Return of Spontaneous Circulation (ROSC)
  - VT/VF or “shockable rhythm”
  - Possibly asystole / pulseless electrical activity
Hypothermia

• Questions remain
  – Who, how, when to start, for how long
  – Role and value of prehospital hypothermia
  – When to assess neurological recovery
Therapeutic Hypothermia After Out-of-Hospital Cardiac Arrest

Evaluation of a Regional System to Increase Access to Cooling

20% increase risk of death for each hour of delay to initiation of cooling

<table>
<thead>
<tr>
<th>Time ROSC to cooling</th>
<th>Good neuro. outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 39 min</td>
<td>60% 26/43</td>
</tr>
<tr>
<td>40 – 102 min</td>
<td>49% 21/43</td>
</tr>
<tr>
<td>&gt;102 min</td>
<td>45% 19/42</td>
</tr>
</tbody>
</table>

Code Cool

1. Induction

2. Maintenance

3. Rewarming

Carolinias Medical Center (CMC)
Therapeutic Hypothermia Post Cardiac Arrest
CMC Critical Care Committee

Initiate: CMC Therapeutic Hypothermia Post Cardiac Arrest
Verify Allergies:

Admit to: ICU under Dr.: ___________________ List: __________
Condition: Critical
Diagnosis: Cardiac Arrest
Notify Paging Operator at 355-2448 to activate Code Cool

Consults:
- Pulmonary and Critical Care Consultants (PCCC): page 3757 immediately, unless previously notified
- Sanger Cardiology
- Physical Medicine and Rehabilitation - List 06287
Activate Group Page 8760 for family support referral

Treatment Parameters:
Refer to: CMC Therapeutic Hypothermia After Cardiac Arrest Guideline
Goal Temperature 33°C
Minimize FiO₂ to maintain SpO₂ greater than 95%
Maintain Mean Arterial Pressure (MAP) greater than 65 mmHg
Maintain PaCO₂ of 35 - 45 mmHg

Pharmacy/Treatments and Interventions Weight: _________ kg
Hold all orders for Beta Blockers and Antihypertensive medications
Maintenance IV Fluids: _________ at _________ ml per hour
Norepinephrine (Levophed) 5 mcg/min; titrate to maintain MAP greater than 65 mmHg

Induction Phase (if not completed in the ED)
- Place Temperature monitoring Foley catheter
- Initiate refrigerated (4°C) IV NS 30 ml/kg bolus over 1 hour as tolerated
- Apply Cooling Device with goal temperature set to 33°C

Pantoprazole (Protonix) 40 mg IV Q24H, first dose upon admission to ICU

Shivering Protocol:
- Initiate sedation per CMC Sedation and Analgesia for the Mechanically Ventilated Non-Paralyzed Patient (MD to initiate)
- For refractory shivering: Vecuronium (Norcuron) 0.1 mg/kg IV Push QIH PRN shivering

Maintenance Phase
- Maintain temperature of 33°C for 24 hours via Cooling Device

Rewarming Phase
- Begin controlled re-warming at less than 0.5°C per hour to 37°C via Cooling Device
- Discontinue sedation once 36°C is achieved
- Cooling Device to remain operational with goal temperature of 37°C until order received to discontinue

Refer to: CMC Subcutaneous Insulin Orders for the Non-Pregnant Patient (MD to initiate)
Implement: SC CMC Tight Glucose Control for the Adult Patient in MICU SICU TICU DHU CVRU or Neuro ICU (EndoTool™) if 2 consecutive blood glucose checks greater than 150 mg/dL
Induced Hypothermia

**History**
- Non-traumatic cardiac arrest (drowning and hanging are permissible in this protocol)

**Signs and Symptoms**
- Return of pulse

**Differential**
- Continue to address specific differentials associated with the original dysrhythmia

**Legend**
- EMT
- EMT-I
- EMT-P
- APP
- A
- M
- MC Order

**Flowchart**
1. **Postresuscitation Protocol**
   - If unsuccessful, go to next step.
   - If successful, go to next step.

2. **Airway Management Protocols**
   - If advanced airway is in place with ETCO₂ > 20 mmHg?
     - Perform Neuro Exam Per IH Job Aide

3. **ROSC**
   - Criteria for Induced Hypothermia and initial temp >34C
     - Advanced airway in place with ETCO₂ > 20 mmHg?
       - Perform Neuro Exam Per IH Job Aide

4. **Expose Patient**
   - Cold Saline Bolus 30 mL/kg to max 2 liters
     - Dopamine 10-20 mcg/kg/min target MAP 90-100

5. **Reassess Temperature**
   - <33 C
     - Discontinue Cooling Measures
   - >33 C
     - Reassess Temperature
     - Pt Shivering
       - Etomidate 20 mg IV/IO
         - Consider Vecuronium 0.15 mg/kg to max 10 mg

6. **Continue to Monitor Temperature and Go to Postresuscitation Protocol**

**Pearls**
- Criteria for Induced Hypothermia
- ROSC not related to blunt/penetrating trauma or hemorrhage
- Age 12 or older with adult body habitus
- Temperature after ROSC greater than 34 C degrees
- Advanced airway in place with no purposeful response to pain
- If no advanced airway can be obtained, cooling may only be initiated on order from online medical control
- Take care to protect patient modestly, Undergarments may remain in place during cooling
- Do not delay transport to cool
- Frequently monitor airway, especially after each patient move
- Patients may develop metabolic alkalosis with cooling, Do not hyperventilate
Surface cooling pads
Complications of hypothermia

- Increased pneumonia / sepsis risk
- Hypovolemia
- Bradycardia
- Hyperglycemia
- Decreased drug clearance
- Increased bleeding
- Shivering
- Loss of K, Mg, Phos, Ca.
- Hyperkalemia in rewarming stage

Polderman KH, Crit Care Med 2009; 37:1101–1120
URGENT CORONARY ANGIOGRAPHY
Who should go to the cath. lab?

All patients

versus

Only patients with obvious STEMI
IMMEDIATE CORONARY ANGIOGRAPHY IN SURVIVORS OF OUT-OF-HOSPITAL CARDIAC ARREST

CHRISTIAN M. SPAULDING, M.D., LUC-MARIE JOLY, M.D., ALAIN ROSENBERG, M.D., MEHRAN MONCHI, M.D., SIMON N. WEBER, M.D., JEAN-FRANÇOIS A. DHAINAUT, M.D., PH.D., AND PIERRE CARLI, M.D.

84 consecutive cardiac arrest patients

No sign.
CAD
n = 24

50 - 90%
CAD
n = 20

100%
CAD
n = 40

9 of 40
no ST elevation and
no chest pain

Spaulding et al. NEJM 1997;336:1629-33
PROCAT (Parisian Region Out of Hospital Cardiac Arrest) Registry

435
Out of hospital cardiac arrest

134 (31%)
ST elevation

128 (96%)
Sig. lesion

99 (74%)
PCI

6 (4%)
No sig. lesion

301 (69%)
Other ECG

176 (58%)
Sig. lesion

125 (42%)
No sig. lesion

78 (26%)
PCI

1,198 patients with isolated ant. ST depression

314 (26%) had an occluded culprit artery
# Epidemiology

Autopsy – witnessed arrest, Nottingham UK

<table>
<thead>
<tr>
<th></th>
<th>VF</th>
<th>Other (Asystole, PEA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous MI</td>
<td>53%</td>
<td>45%</td>
</tr>
<tr>
<td>CAD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None - mild</td>
<td>7%</td>
<td>5%</td>
</tr>
<tr>
<td>1 Vessel</td>
<td>13%</td>
<td>10%</td>
</tr>
<tr>
<td>2 Vessel</td>
<td>23%</td>
<td>15%</td>
</tr>
<tr>
<td>3 Vessel</td>
<td>37%</td>
<td>41%</td>
</tr>
<tr>
<td>Thrombosis</td>
<td>31%</td>
<td>30%</td>
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<tr>
<td>LVH</td>
<td>53%</td>
<td>54%</td>
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</tbody>
</table>

Out of hospital cardiac arrest survivors
Long-term survival by procedure

Kings County, WA
2001-2009
1001 discharged alive of 5958 cardiac arrests

<table>
<thead>
<tr>
<th>PCI</th>
<th>No PCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age*</td>
<td>59</td>
</tr>
<tr>
<td>VF*</td>
<td>90%</td>
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<tr>
<td>Witnessed*</td>
<td>93%</td>
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<tr>
<td>Bystander CPR</td>
<td>48%</td>
</tr>
<tr>
<td>Cardiomyopathy*</td>
<td>12%</td>
</tr>
</tbody>
</table>

P values <0.01*

Out of hospital cardiac arrest survivors
Long-term survival by procedure

Survival by PCI

PCI

No PCI

Out of hospital cardiac arrest survivors
Long-term survival by procedure

Survival by PCI and therapeutic hypothermia (TH)

PCI / TH
PCI / no TH
No PCI / TH
No PCI / no TH

Out of hospital cardiac arrest survivors
Long-term survival by procedure

Proportional Hazards Model Adjustment

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Hazard Ratio</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCI</td>
<td>0.55</td>
<td>0.40-0.76</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Therapeutic Hypothermia</td>
<td>0.67</td>
<td>0.47-0.95</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Adjusted for age, sex, initial rhythm, etiology, arrest location, witnessed, bystander CPR, EMS response interval, DM, dyslipidemia, smoking, HTN, cardiomyopathy, etiology, CAD, CPC score, year

CPR
Bystander CPR
2.4 times survival to hospital discharge

Baseline survival

- 0 – 2.1: 1.2
- 2.1 – 4.1: 1.2
- 4.2 – 6.7: 2.7
- 6.8 – 9.0: 1.0
- 9.1 +: 1.2
- Overall: 2.4

*Circ Cardiovasc Qual Outcomes. 2010;3:63-81*
Chest-compression-only vs. standard CPR
Meta-analysis of randomized dispatch instruction

Survival to hospital discharge in 3 trials

<table>
<thead>
<tr>
<th></th>
<th>Chest-compression-only CPR</th>
<th>Standard CPR</th>
<th>Risk ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hallstrom et al (2000)\textsuperscript{14}</td>
<td>35/240 (15%)</td>
<td>29/278 (10%)</td>
<td>1.40 (0.88–2.22)</td>
</tr>
<tr>
<td>Rea et al (2010)\textsuperscript{15}</td>
<td>122/978 (12%)</td>
<td>105/956 (11%)</td>
<td>1.14 (0.89–1.45)</td>
</tr>
<tr>
<td>Svensson et al (2010)\textsuperscript{16}</td>
<td>54/282 (19%)</td>
<td>44/297 (15%)</td>
<td>1.29 (0.90–1.86)</td>
</tr>
<tr>
<td>Overall</td>
<td>211/1500 (14%)</td>
<td>178/1531 (12%)</td>
<td>1.2  (1.01–1.46)</td>
</tr>
</tbody>
</table>

Favors standard CPR  Favors compression only CPR

P = 0.04

*Lancet* 2010; 376: 1552–57
Chest compression only CPR

- Bystanders more willing to initiate
- Arterial blood is adequately oxygenated at onset of primary cardiac arrest
- Less likely to cause regurgitation of stomach contents
- Rescue breathing interrupts critical chest compressions
- Easier to teach
- Observational evidence of improved survival

Bystander CPR

Simplifying to hands-only CPR

Experts now believe an adult who suddenly collapses due to cardiac arrest has enough air in his lungs and blood during CPR and doesn't need mouth-to-mouth breathing.

If you see someone collapse ...

... have someone call 911.
Position unresponsive adult.
Press about 2 inches below the nipple line for a chest center.
Use an automated external defibrillator if available.
Keep CPR interruptions to a minimum.

Begin hands-only CPR with straight arms and forceful compressions at about 100 a minute.
Lift hands slightly after each to allow chest to recoil.
Take turns with a bystander until emergency medical services arrive.

SOURCES: University of Arizona Sarver Heart Center; American Heart Association

HeartRescue Project

Medtronic Foundation
Chest Compression-Only CPR by Lay Rescuers and Survival From Out-of-Hospital Cardiac Arrest

Bobrow et al. JAMA 2010;304:1447-1454
Bystander CPR for OHCA in Arizona (2005 to 2010)

Overall incidence of bystander CPR

%  
100%  
80%  
60%  
40%  
20%  
0%  

2005 2006 2007 2008 2009

28%  
40%  
P < 0.05

Bobrow, et al. JAMA 2010;304:1447-1454
Bystander CPR for OHCA in Arizona (2005 to 2010)

Percent of lay CPR providers who performed CO-CPR

P < 0.0001

Bobrow, et al. JAMA 2010;304:1447-1454
Chest Compression-Only CPR by Lay Rescuers and Survival From Out-of-Hospital Cardiac Arrest

**A. All OHCA**

AOR 1.6 (95% CI, 1.08-2.35)

- Std-CPR: 7.8%
- CO-CPR: 13.3%

**B. Witnessed/Shockable**

- Std-CPR: 17.7%
- CO-CPR: 33.7%

Bobrow, et al. JAMA 2010;304:1447-1454
CPR Quality
Coronary Perfusion pressure (Ao diastolic- RA diastolic)
506 patients with VF / VT and no defib. before EMS arrival.

Electronically recorded cardiopulmonary resuscitation before the first shock.

Age 64, 80% male

51% bystander CPR

6 minutes call to scene

11 minutes call to first shock.

ROSC 72%

Survived to discharge 23%

Dispatcher Instruction
Amsterdam dispatch

506 cardiac arrest emergency calls (3%)

Unrecognized, dispatch 0.9 min later, on scene 1.4 minute later

Main reason for not recognizing the cardiac arrest was not asking if the patient was breathing (42 of 82) / describe the type of breathing

Odds ratio of survival by CPR status and BLS response time
Witnessed cardiac arrest, King County 1983 – 2000, n = 7265

Dispatcher instructed CPR  Bystander CPR

No CPR reference

Can we improve bystander CPR rates from 18% to 40% in Durham?
**Medicine**

The Durham area has one of the highest per capita concentrations of hospital beds and physicians in the world. With over 2,300 physicians, there is an approximate average of 10.6 physicians per 1000 residents in Durham. Two excellent university teaching hospitals are located in the area -- Duke Medical Center in Durham and UNC Hospitals (state teaching hospital) in Chapel Hill.
Durham as case study in cardiac arrest

- Bystander CPR rate in 2010 was 18% (24% nationally, 40% in Seattle and Arizona)
- Duke is number one employer in Durham
- “Hands-only CPR” can be taught with 5 minute training module
- Program to train all Duke employees to perform CPR
Can we identify patterns of frequency of arrests, bystander CPR rates, time to response at neighborhood level to improve care?
Attempted resuscitations 2009-2010
Bystander CPR rates by Neighborhood

Wake County

Durham County

Mecklenburg County

Percent of Cardiac Arrests
Where Bystander CPR Performed

0% 0.01% - 25%
25.01% - 40%
40.01% - 60%
60.01% - 100%
No Cardiac Arrest Events

Percent of Cardiac Arrests
Where Bystander CPR Performed

0.01% - 33.33%
33.34% - 44.44%
44.45% - 66.67%
66.68% - 100%
No Cardiac Arrest Events

Fosbol
Duke Football Game
September 1, 2012
>500 people trained in CPR
(8 people, 4 hours = 16 trained per man-hour)
To improve CPR rates in Durham and in NC, where should we start?
<table>
<thead>
<tr>
<th>Health System</th>
<th>Number of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carolinas HealthCare System</td>
<td>48,120</td>
</tr>
<tr>
<td>UNC</td>
<td>44,200</td>
</tr>
<tr>
<td>Duke University</td>
<td>33,705</td>
</tr>
<tr>
<td>Vidant Health</td>
<td>11,000</td>
</tr>
<tr>
<td>Presbyterian Healthcare</td>
<td>9,000</td>
</tr>
<tr>
<td>WakeMed</td>
<td>7,000</td>
</tr>
<tr>
<td>New Hanover Regional Medical Center</td>
<td>5,400</td>
</tr>
</tbody>
</table>
Dispatchers should instruct untrained lay rescuers to provide Hands-Only CPR for adults who are unresponsive with no breathing or no normal breathing.
How do we improve application of hypothermia?
Hypothermia for PEA arrest?
Can we predict no chance for recovery within 5 days?

47-year-old woman with a history of atrial fibrillation, recently started on dofetilide, who suffered a witnessed ventricular fibrillation cardiac arrest while a passenger in a car on April 5th 2011 at about 10:30 a.m.

- PEA on ED arrival, 45 min of CPR
- Therapeutic hypothermia begun
- Shock, acute renal failure treated with dialysis, and severe anoxic brain injury.
April 11 (6 days after arrest). No response to commands. GCS 5. Multisystem organ failure.

My note:
“2. Cardiac arrest and anoxic encephalopathy. Her chance of recovery is becoming very small. We discussed her situation with her husband. “

April 13 (8 days after arrest). Still comatose. “We had a long discussion with her family, including review of her decreasing likelihood of good recovery, and what she would want us to do under that circumstance.

Decision to continue care. Trach/PEG April 15.
- Discharged April 28, still on dialysis, moving around, but not following commands or speaking
- Since has made complete recovery – returned to cardiology clinic January 11
- Had long discussion with her and her husband at Costco last Sunday
Improving outcomes in cardiac arrest

Conclusions:

• Cardiac arrest is common and care and outcomes are heterogeneous.
• There are some regions including Rowan, Mecklenburg and Wake counties with higher survival rates.
• Simple interventions in the chain of survival improve survival, with focus on bystander CPR, EMS protocols, primary PCI, therapeutic hypothermia.
• 50% improvement in survival is a bold but realistic goal.
• Regional systems will play a key role in improving regional care of cardiovascular emergencies.