A VERY COOL WAY TO SAVE LIVES:
INTRA-ARREST THERAPEUTIC HYPOTHERMIA

John Freese, M.D.
Chief Medical Director
Fire Department of New York
The Enemy
The Answer
Let’s Forget This For Now
Aug 1, 2010: NYC Project Hypothermia – Phase II begins

NEW PROTOCOL
503 C
POST RESUSCITATION MANAGEMENT FOR NON-TRAUMATIC CARDIAC ARRESTS

1. Perform, record, and evaluate a 12-lead EKG.
2. If the patient is intubated, ensure adequate ventilation to maintain a waveform Capnography values between 35-45 mmHg.
3. Administer Dacoramine 5 ug/kg/min, IV/Saline drip to maintain a systolic blood pressure >90 mmHg. If there is insufficient improvement in hemodynamic status, the infusion rate may be increased until the desired therapeutic effects are achieved or adverse effects appear. (Maximum dosage is 20 ug/kg/min, IV/Saline drip.)
4. If the patient is NOT awake and NOT able to follow commands:
   a. Continue the infusion of ice cold (4°C) normal saline via IV / IO to a total of 30cc/Kg (maximum total volume = 2 liters).
   b. Administer Midazolam 0.1mg/kg IV / IO (maximum dose 2mg) for active shivering and/or agitation.
5. Initiate transport.
6. If the nearest 911 receiving facility is not a Cardiac Arrest Center, contact CMC to request selective transport to the nearest Cardiac Arrest Center.
   a. If the 12-lead EKG performed meets STEMI criteria, contact CMC to request selective transport to a Cardiac Arrest Center that is also capable of performing PCI.

NOTE: CMC APPROVAL IS REQUIRED FOR ALL STEMI TRANSPORTS, EVEN WHEN THE NEAREST 911 RECEIVING FACILITY IS ALSO A STEMI CENTER, INCLUDING 12-LEAD EKG TRANSMISSION.

7. Contact Medical Control for implementation of one or more of the following MEDICAL CONTROL OPTIONS:

MEDICAL CONTROL OPTIONS:

OPTION A: For shivering prophylaxis or treatment, administer Fentanyl 1 mcg/kg IV / IO, IF AVAILABLE, (maximum dose 100 mcg).
One clarification…
Physiologic Basis for Hypothermia
Slowed cellular metabolism
 Interruption of apoptotic pathway
 Attenuation of “excitotoxic arrest” pathways
 Suppressed inflammatory response
 Reduced free radical production
 Reduction of ICP
 Maintenance of microvascular integrity
 Reduced accumulation of intracellular lactate
 Improved glucose metabolism
 Improved mitochondrial oxidative phosphorylation
 Combats hypercoagulable state that results from ischemic insult
 Reduced production of thromboxane A2 and prostaglandin I2
 Improved tolerance for cerebral ischemia
 Reduced neurologic injury from convulsive and nonconvulsive seizures
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Intra-Arrest Cooling

Project Hypothermia EMS Protocol
- CPR (including delayed defibrillation for non-EMS witnessed arrests)
- initial defibrillation attempts
- airway management (including intubation)
- consider treatments for reversible causes of bradyasystolic arrests
- vasopressin
- epinephrine
- atropine
- amiodarone
- additional treatments after consultation with medical control physicians
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Intra-Arrest Cooling

Intra-arrest initiation of therapeutic hypothermia
- large-bore (≥18g or greater) IV or IO access
- ice-cold saline (stored at 2.5°C, infusion ~4°C)
- large-volume (30cc/kg, maximum 2 liters)
- pressure infusion sleeve

Exclusions
- pulmonary edema
- neurologically intact following initial resuscitation
- loss of or inability to maintain IV/IO access
- ice-cold saline not available at the time of resuscitation
Intra-Arrest Cooling

Quick Answers to Three Quick Questions:
1. Does intra-arrest cooling work? (Are patients being cooled?)

2. Does intra-arrest cooling harm patients?

3. Does intra-arrest cooling change outcomes?
Intra-Arrest Cooling

Does intra-arrest cooling work?
(Are patients being cooled?)
Intra-Arrest Cooling

Average patient (N=552)
Initial Temp = 35.6°C
Δ Temp = -1.6°C
Final Temp = 34.0°C
Intra-Arrest Cooling

Does intra-arrest cooling harm patients?
Potential for harm

- large-volumes to patients with no cardiac function
- some studies suggested potential to induce pulmonary edema
- post-resuscitation interview included QA questions
Intra-Arrest Cooling

Potential for harm (8/1/10-12/31/11)
- 7,934 patients cooled
- Average volume = 1,171 ml

- 690 (8.7%) developed pulmonary edema
- Average volume = 992 ml
Does intra-arrest cooling change outcomes?
Intra-Arrest Cooling

Does intra-arrest cooling change (immediate) outcomes?
Intra-Arrest Cooling

Control Period = 5,738 resuscitations

Study Period = 5,856 resuscitations with LVICS

4,571**

** Due to the lack of required equipment among some advanced life support ambulances in the New York City 911 system during the study period.
# Intra-Arrest Cooling

<table>
<thead>
<tr>
<th></th>
<th>Control Period</th>
<th>Study Period (with LVICS)</th>
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<tbody>
<tr>
<td>N</td>
<td>5,738</td>
<td>4,571</td>
<td>0.821</td>
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<tr>
<td>Male gender</td>
<td>3,008 (52.4%)</td>
<td>2,386 (52.2%)</td>
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<tr>
<td>Age &lt; 80</td>
<td>3,777 (65.8%)</td>
<td>2,938 (64.3%)</td>
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<tr>
<td>Race (black)</td>
<td>1,644 (28.7%)</td>
<td>1,338 (29.3%)</td>
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<tr>
<td>EMS &lt; 5 min</td>
<td>3,819 (66.6%)</td>
<td>3,124 (68.3%)</td>
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<td>Cardiac Etiology</td>
<td>4,447 (77.5%)</td>
<td>3,578 (78.3%)</td>
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<tr>
<td>Bystander Witnessed</td>
<td>1,731 (30.2%)</td>
<td>1,444 (31.6%)</td>
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<tr>
<td>EMS Witnessed</td>
<td>516 (8.9%)</td>
<td>364 (8.0%)</td>
<td>0.068</td>
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<tr>
<td>Bystander CPR</td>
<td>1,853 (32.3%)</td>
<td>1,509 (33.0%)</td>
<td>0.769</td>
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</table>

Table 2

No Differences
Intra-Arrest Cooling

ROSC

Control Period: 27.90%
Study Period (LVICS): 32.57%

P<0.001
Intra-Arrest Cooling

ROSC

Control Period: 27.90%
Study Period (LVICS): 32.57%
Study Period (>150cc): 38.04%

P<0.001

P<0.001

P<0.001
Intra-Arrest Cooling

Pulmonary Edema

ROSC

<table>
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<tr>
<td>Pulmonary Edema</td>
<td>37.71%</td>
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City paramedics now use hypothermia therapy in ambulances to save cardiac arrest patients

BY FRANK LOMBARDI
DAILY NEWS CITY HALL BUREAU
Tuesday, August 03, 2010

City paramedics have begun a pioneering program to treat some cardiac arrest victims in ambulances with a body-chilling therapy that can increase survival rates without brain damage.

Up to now, hypothermia therapy - in which a chilled saline solution is administered intravenously to decrease body temperature by as much as nine degrees - has only been provided once patients reached prescribed hospitals.

Lowering body temperature has been found to slow down the brain's need for oxygen, providing precious additional time to rush victims to emergency rooms where the cause of the cardiac arrest can be found and treated.
Early Initiation vs Intra-Arrest Initiation

From: "Peter Wyer" <pwyer@att.net>
RE: hypothermia protocols---OOPS---(hate being right all the time)
Jan 24, 2012 19:27

1 Attachment

Folks:

I assume most of you are ahead of me on this, but I have attached the ICE study for stragglers like me. It seems to indicate that, at least for...
Early Initiation vs Intra-Arrest Initiation

Does early initiation of TH harm patients?  
Maybe.

If so, should this preclude consideration / examination of intra-arrest TH?  
Absolutely not.

We are applying TH:
- in the setting of a different physiology
- with a different intended pharmacologic purpose
- when we have nothing else of proven value to offer
Early Initiation vs Intra-Arrest Initiation

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Early Initiation vs Intra-Arrest Initiation

Post-arrest vs. Intra-Arrest
- epinephrine
- dopamine
- atropine
- pacing
- defibrillation vs synchronized cardioversion
- etc, etc, etc...
Intra-Arrest Cooling

Take-home points:
- It appears to be safe.
- It appears to be effective.
- It appears to improve immediate outcomes.
- This is still an unproven therapy.
- Effects on long-term outcome unknown.
- Without in-hospital TH, this does not matter.
My Thanks to Them

And Thank You!!