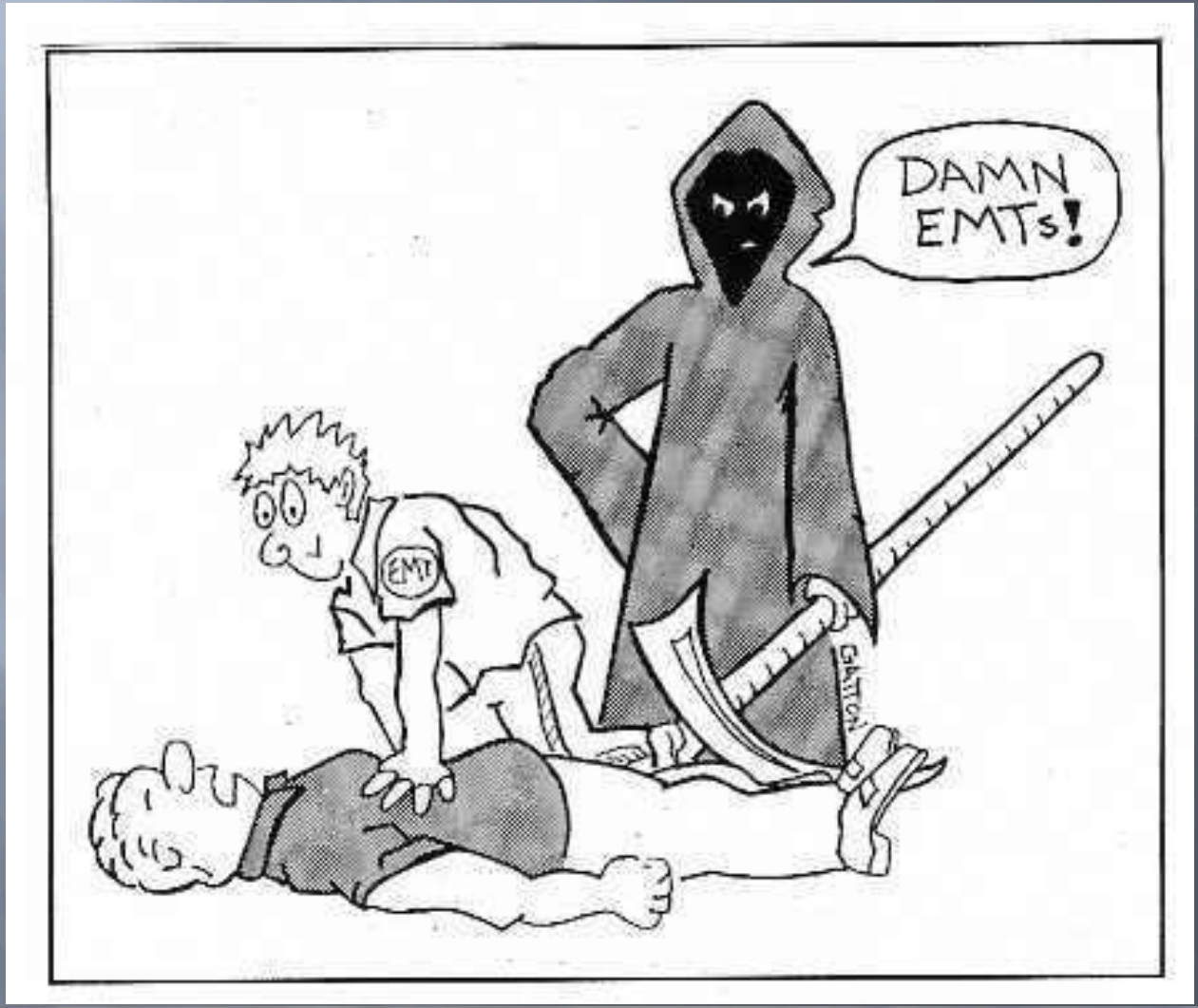
# A VERY COOL WAY TO SAVE LIVES:
## INTRA-ARREST THERAPEUTIC HYPOTHERMIA

**John Freese, M.D.**
**Chief Medical Director**
**Fire Department of New York**

# The Enemy

# The Answer



# Let's Forget This For Now

Contents lists available at SciVerse ScienceDirect

Resuscitation

Journal homepage: www.elsevier.com/locate/resuscitation

Clinical paper

## Early- versus late-initiation of therapeutic hypothermia after cardiac arrest: Preliminary observations from the experience of 17 Italian intensive care units☆

The Italian Cooling Experience (ICE) Study Group[a]

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ABSTRACT

*Objectives:* Mild therapeutic hypothermia (TH) has been shown to improve neurologic outcome in patients experiencing cardiac arrest after return of spontaneous circulation (ROSC). The best timing to initiate TH is currently not known. The aim of this study by the *ICE* (*Italian Cooling Experience*) group was to investigate the relationship between the timing of initiation of therapeutic hypothermia (TH) and both patient survival and neurologic outcome.

*Methods:* In this observational prospective clinical study we collected data on cardiac arrest patients admitted, after ROSC, to any of the 17 participating Italian intensive care units. Patients were managed according to routine clinical practice, including, in a group of patients, therapeutic hypothermia. Patients who underwent TH were classified, arbitrarily, into an early-initiation group (TH started <2 h since cardiac arrest) and a late-initiation group (TH started >2 h since cardiac arrest).

*Results:* Intensive care unit (ICU) mortality was 47.4% for the early-initiation group and 23.8% for the late-initiation group ($P = 0.01$). Six-month mortality was 60.8% for the early-initiation group and 40.5% for the late-initiation group ($P = 0.04$). Cerebral performance category (CPC, a measure of neuro-cognitive outcome) at ICU discharge was 1 [1–2] for the early-initiation group and 1 [1–3] for the late-initiation group ($P = 0.57$). At 6 months, CPC was 1 [1–1] for the early-initiation group and 1 [1–2] for the late-initiation group.

*Discussion:* Despite similar neurologic outcomes at every time point, mortality was significantly higher when therapeutic hypothermia was started within 2 h of cardiac arrest than when it was started later. Due to the lack of possibility to control several putative confounding factors, such results should be considered as preliminary observations warranting further research.

# Intra-Arrest Cooling

## 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 Dopamine 5 ug/kg/min, IV/Saline Lock drip to maintain a systolic blood pressure >90mmHg. 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 Lock drip.)
4. If the patient is NOT awake and NOT able to follow commands:
   a. Continue the infusion of ice cold (4° Celsius) 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 OLMC to request selective transport to the nearest Cardiac Arrest Center.
   a. If the 12-lead EKG performed meets STEMI criteria, contact OLMC to request selective transport to a Cardiac Arrest Center that is also capable of performing PCI.

NOTE: OLMC 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:

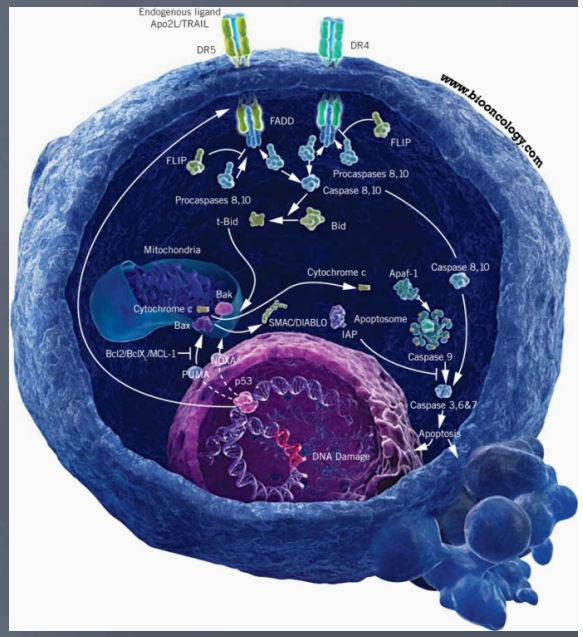
MEDICAL CONTROL OPTIONS:

OPTION A: For shivering prophylaxis or treatment, administer Fentanyl 1mcg/kg IV/IO, IF AVAILABLE, (maximum dose 100mcg).

# One clarification…

# Intra-Arrest Cooling

## 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

# Intra-Arrest Cooling

## Physiologic Basis for Hypothermia

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Interruption of apoptotic pathway

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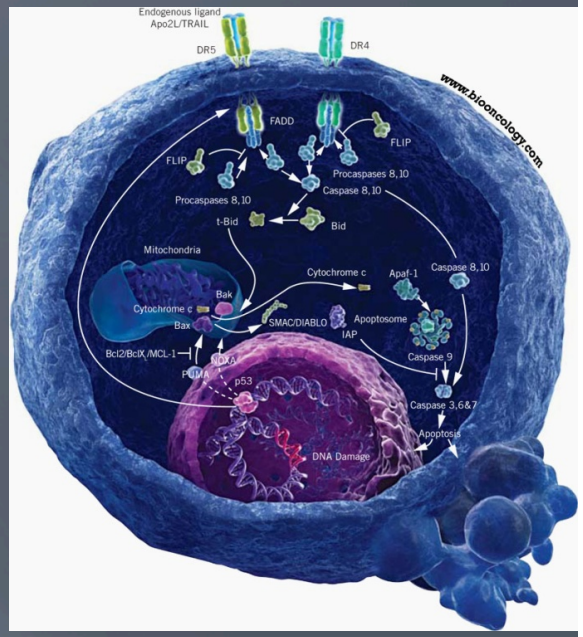

# Intra-Arrest Cooling

**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**

# Intra-Arrest Cooling

Project Hypothermia EMS Protocol

- CPR (including delayed defibrillation for non-EMS witnessed arrests)
- initial defibrillation attempts
- airway management (including intubation)
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- intra-arrest initiation of therapeutic hypothermia
- vasopressin
- epinephrine
- ~~atropine~~
- amiodarone
- additional treatments after consultation with medical control physicians

# 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?)**

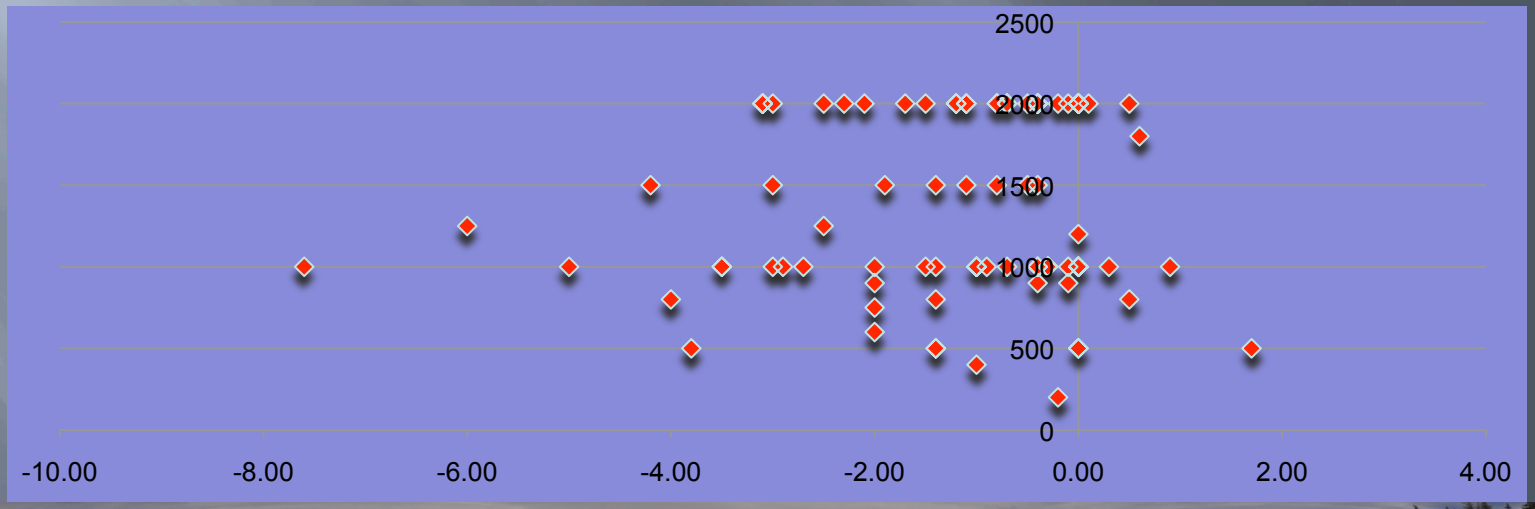
# Intra-Arrest Cooling

**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?**

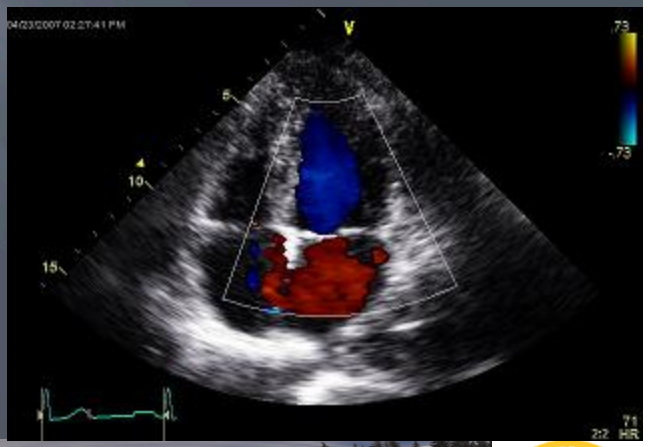
# Intra-Arrest Cooling

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

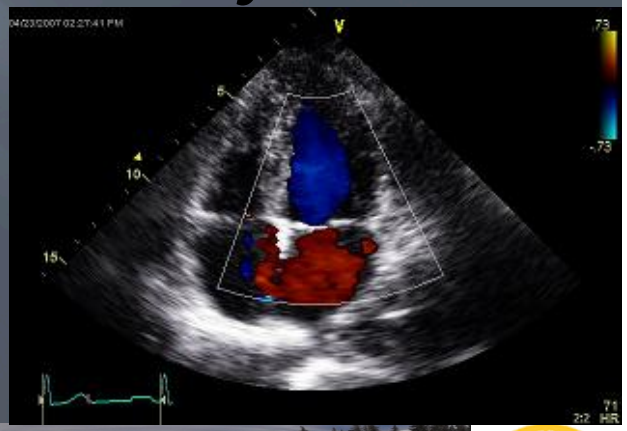


# Intra-Arrest Cooling

**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



# Intra-Arrest Cooling

**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****

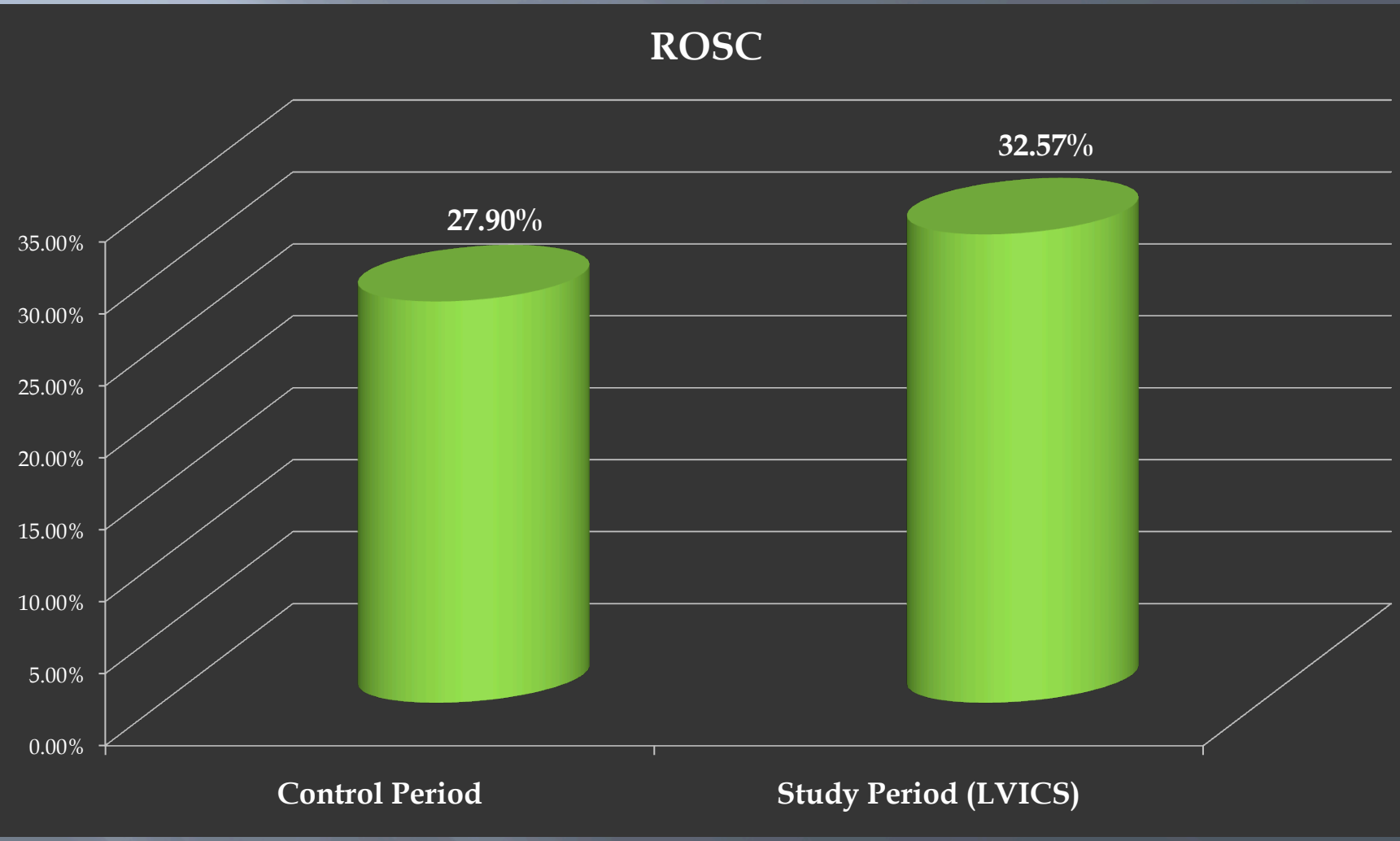
** Due to the lack of required equipment among some advanced life support ambulances in the New York City 911 system during the study period.

# Intra-Arrest Cooling

| | Control Period | Study Period (with LVICS) | p |
|---|---|---|---|
| N | 5,738 | 4,571 | 0.821 |
| Male gender | 3,008 (52.4%) | 2,386 (52.2%) | 0.837 |
| Age < 80 | 3,777 (65.8%) | 2,938 (64.3%) | 0.105 |
| Race (black) | 1,644 (28.7%) | 1,338 (29.3%) | 0.504 |
| EMS < 5 min | 3,819 (66.6%) | 3,124 (68.3%) | 0.057 |
| Cardiac Etiology | 4,447 (77.5%) | 3,578 (78.3%) | 0.359 |
| Bystander Witnessed | 1,731 (30.2%) | 1,444 (31.6%) | 0.125 |
| EMS Witnessed | 516 (8.9%) | 364 (8.0%) | 0.068 |
| Bystander CPR | 1,853 (32.3%) | 1,509 (33.0%) | 0.769 |
| Table 2 | | | |

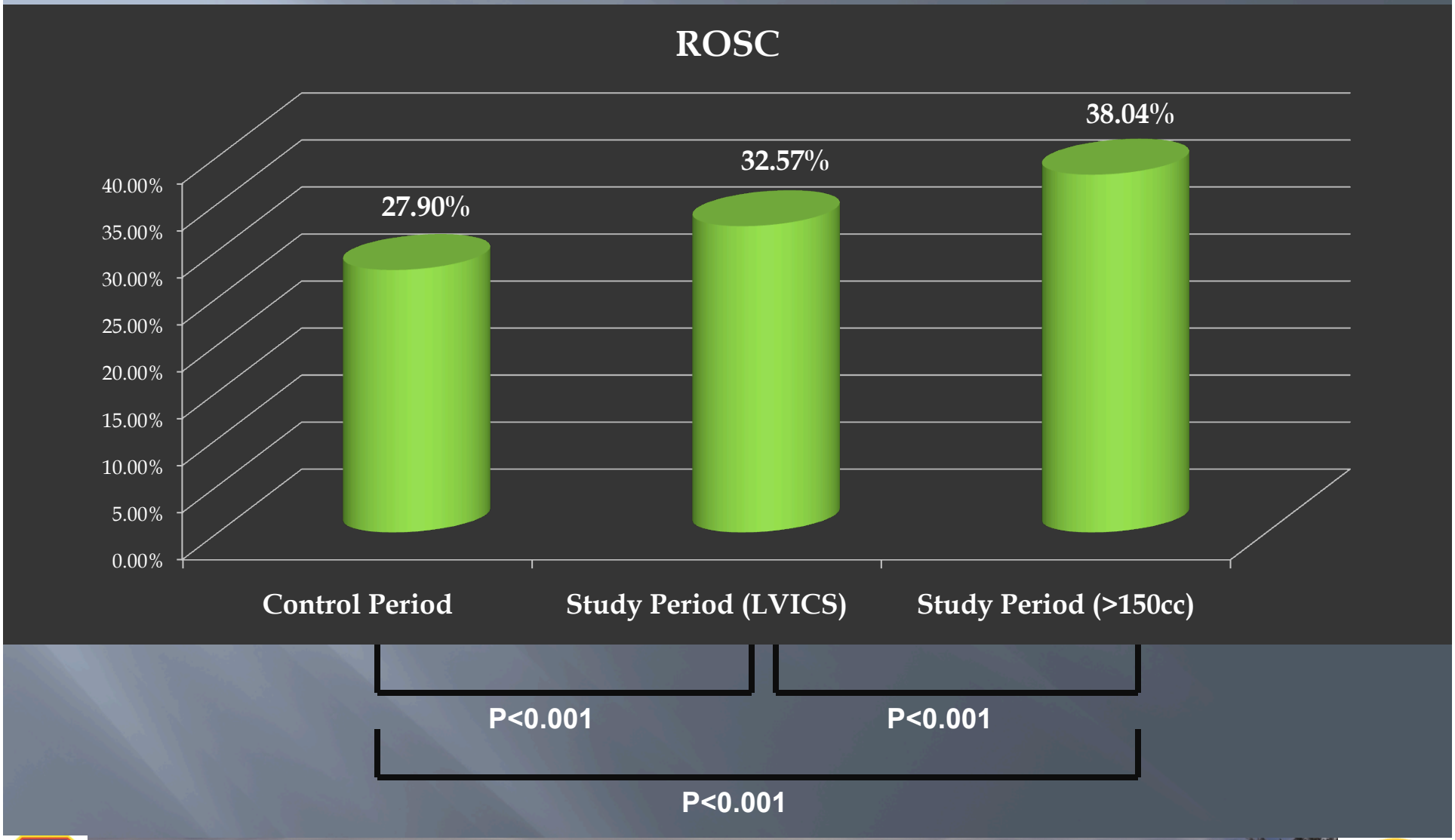
No Differences

# Intra-Arrest Cooling



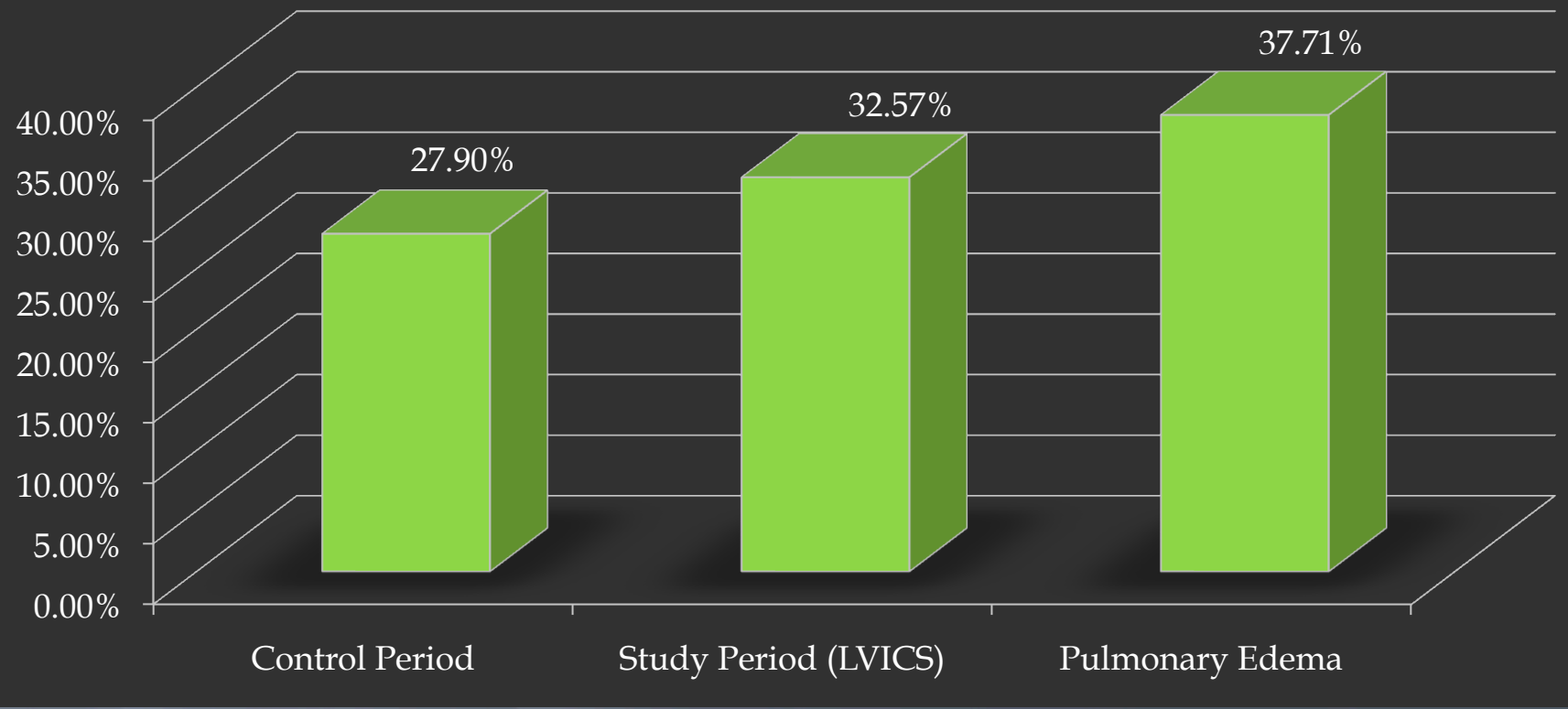

P<0.001

# Intra-Arrest Cooling



# Intra-Arrest Cooling

## Pulmonary Edema



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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

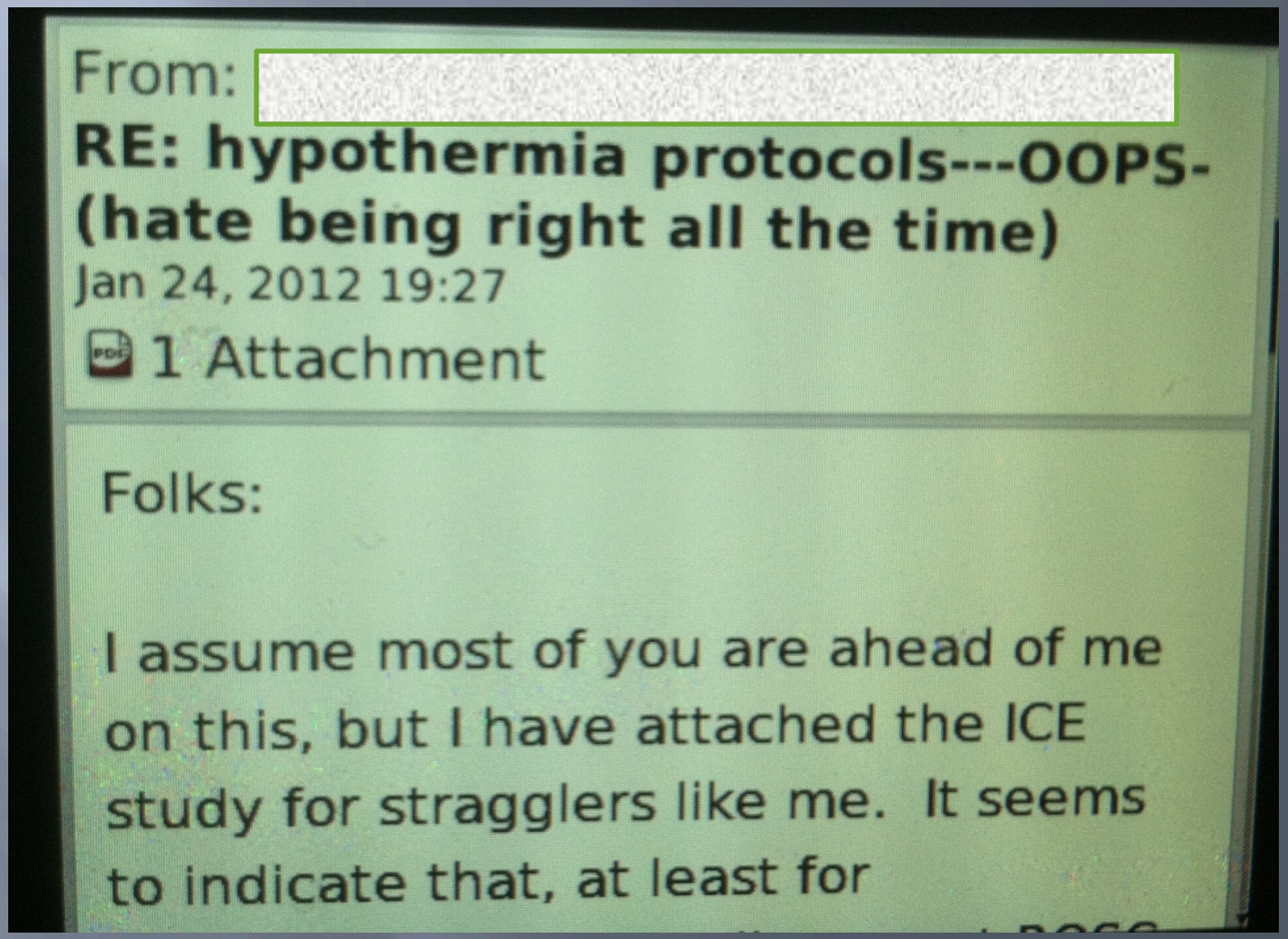
City paramedics have begun a pioneering program to treat some cardiac arrest victims in ambulances with a body-chilling therapy that can increase survival rates without brain damage.

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.

FDNY EMS Paramedics Jim Geronimo (l.) and Alwain White show the new Therapeutic... (DelMundo for News)

# Early Initiation vs Intra-Arrest Initiation



# 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

Project Hypothermia EMS Protocol

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# Early Initiation vs Intra-Arrest Initiation

**Post-arrest vs. Intra-Arrest**

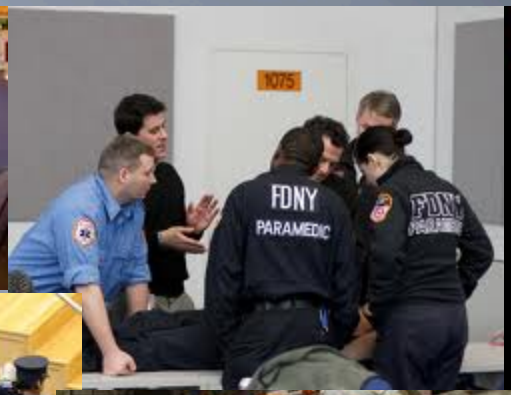
- **epinephrine**
- **dopamine**
- **atropine**
- **pacing**
- **defibrillation vs synchronized cardioversion**
- **etc, etc, etc…**

# 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!!