



# Keeping a Cool Head After Resuscitation

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-and-

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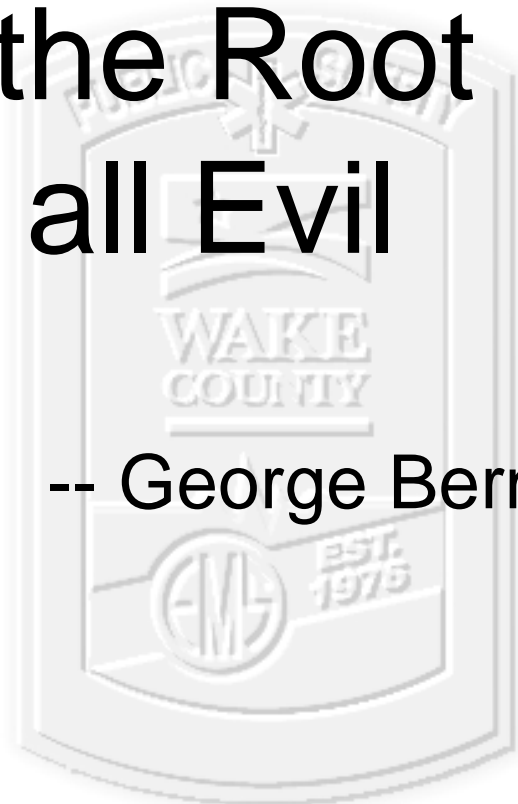
**“Although we await further studies  
With great interest,  
We recommend the use of mild  
Induced hypothermia  
In survivors of cardiac arrest –  
As early as possible and for  
At least 12 hours”**

**-- Peter Safar and Patrick Kochanek, NEJM 2002;346(8):612-3**



# Lack of Money Is the Root Of all Evil

-- George Bernard Shaw





# Our Program: **ICE**

**I**nduced

**C**ooling by

**E**MS





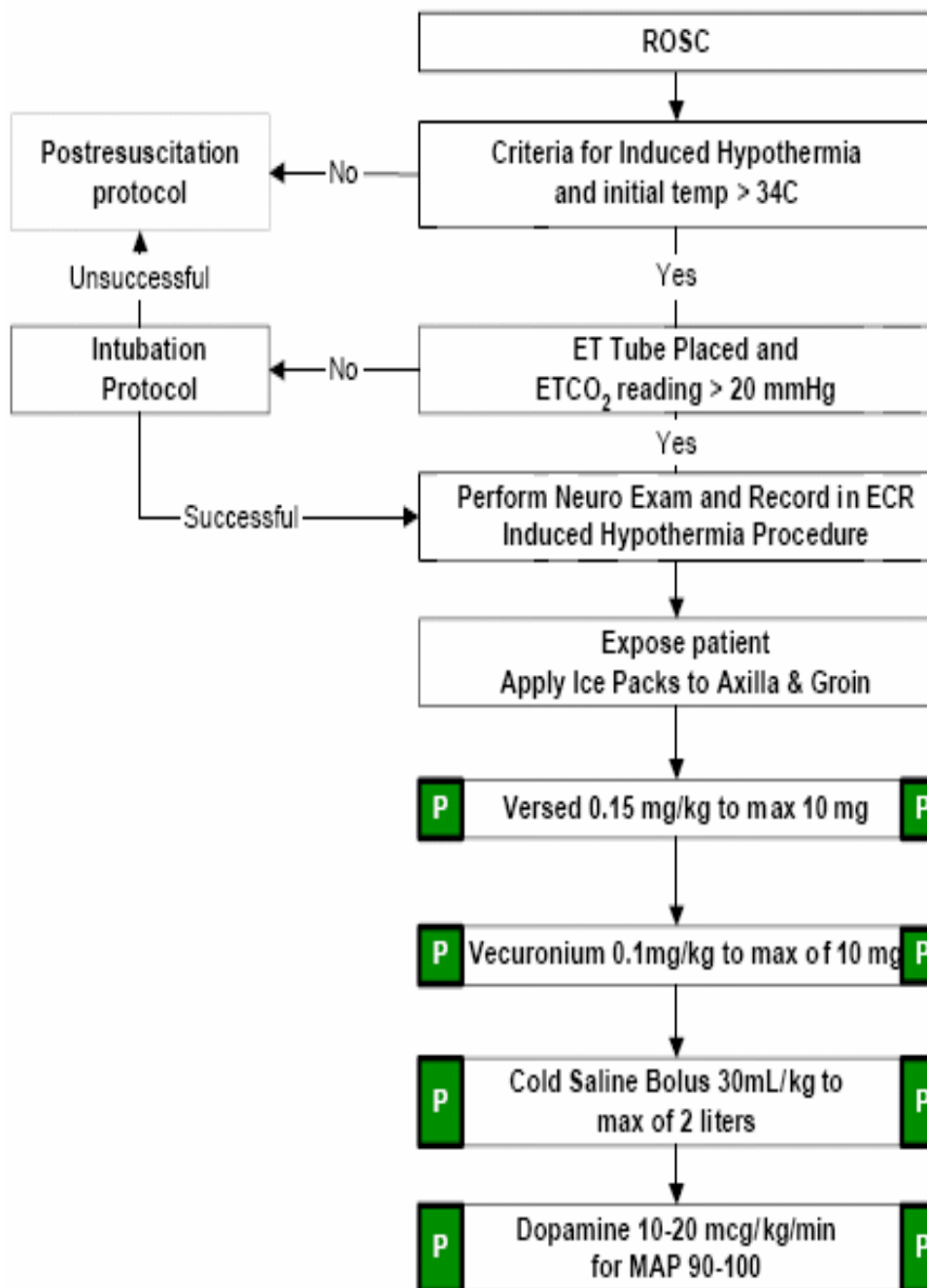
# Elements of Prehospital Hypothermia

- ROSC
  - Uninterrupted compressions, timely defibrillation, controlled ventilations, efficient dispatch
- Method of cooling
  - \$\$ vs. ease of use
- Hospital coordination
  - Selective destination
  - Continuation of cooling

## Pearls:

### • **Criteria for Induced Hypothermia:**

- ROSC after cardiac arrest not related to trauma or hemorrhage.
- Age greater than 16
- Female without obviously gravid uterus
- Initial temperature > 34C
- Patient is intubated and remains comatose (no purposeful response to pain)
- If patient meets other criteria for induced hypothermia and is not intubated, then intubate according to protocol before inducing cooling. If unable to intubate DO **NOT** initiate induced hypothermia.
- When exposing patient for purpose of cooling undergarments may remain in place. Be mindful of your environment and take steps to preserve the patients modesty.
- Do not delay transport for the purpose of cooling.
- Reassess airway frequently and with every patient move.
- Patients develop metabolic alkalosis with cooling. Do not hyperventilate.
- **If there is loss of ROSC after cooling is initiated or any other complication as the result of this protocol please complete hypothermia unusual event reporting form and contact a Medical Director on completion of the call.**



Legend		
	EMT	
I	EMT- I	I
P	EMT- P	P
M	MC Order	M

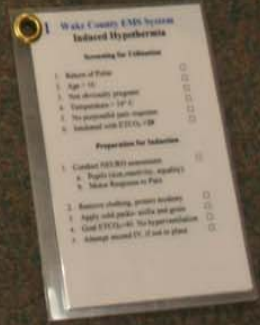
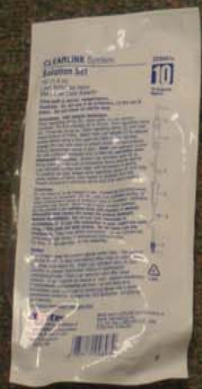
AT ANY TIME  
Loss of Spontaneous Circulation:  
Discontinue cooling and go to appropriate protocol

Monitor ETCO<sub>2</sub> Target 40 mmHg  
DO NOT HYPERVENTILATE









- WAVE Connect EMS System Induced Hypertension**  
 Screening for Evaluation
- 1. Return of Pulse
  - 2. Right I/O
  - 3. Not clinically pregnant
  - 4. Compression 1" x 2"
  - 5. No abnormal pulse waveform
  - 6. Isolated with ECG
- Preparation for Induction
- 1. Conduct ECG with assessment
    - a. Apply V4a, V5a, V6a, V1a, V2a, V3a
    - b. Make Response to Pads
  - 2. Ensure checking, patient location
    - a. Apply and pad location and area
    - b. Load ECG leads. No hyper ventilation
    - c. Always monitor ECG if not in place



Midazolam  
10 mg/mL  
10 mg/mL  
10 mg/mL  
10 mg/mL  
10 mg/mL  
10 mg/mL  
10 mg/mL  
10 mg/mL

Vecuronium Bromide  
10 mg/mL  
10 mg/mL  
10 mg/mL

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# 1 Wake County EMS System Induced Hypothermia

## Screening for Utilization

1. Return of Pulse
2. Age > 16
3. Not obviously pregnant
4. Temperature > 34° C
5. No purposeful pain response
6. Intubated with ETCO<sub>2</sub> >20

## Preparation for Induction

1. Conduct NEURO assessment: 
  - a. Pupils (size, reactivity, equality)
  - b. Motor Response to Pain
2. Remove clothing, protect modesty
3. Apply cold packs- axilla and groin
4. Goal ETCO<sub>2</sub>=40. No hyperventilation
5. Attempt second IV, if not in place



# Hospital Destination

- High volume cardiac catheterization center
- Post-arrest care may include PCI and transfer while in the 24 hour window is cumbersome



# Key Representatives

- Nursing and Physicians from:
  - Emergency
  - CCU
  - ICU
  - NICU
- Nurses are the key representatives
  - Choose device, write standing orders, etc.



# In Hospital Maintenance

- Continuing cooling
- Maintain sedation / paralysis
- Maintain MAP >90mmHg
- Close monitoring of glucose, potassium, volume status, temp
- Skincare if cooling blanket/ice
- Acetaminophen / GI prophylaxis
- Maintain for period of 24 hrs



# Passive Rewarming

- Rewarm at 0.5-1°C/hr
- Takes approx 6-8 hrs
- Paralysis maintained until 36°C
- Monitor for electrolyte and fluid status during re-warming
- Strict normothermia for 48 hrs





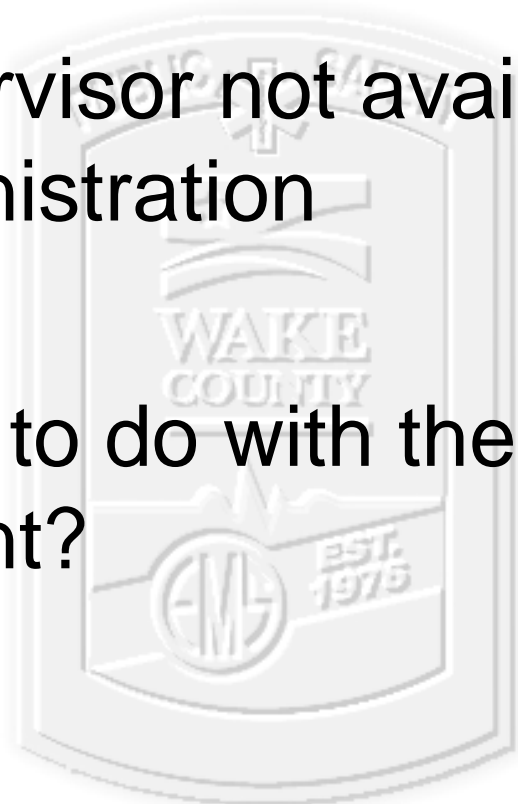
# Pitfalls

- Study criteria as exclusion criteria
  - Non VF/VT arrests
  - Unclear “down time”
- EMS personnel timid with fluid administration
  - Full bolus = 1.5 – 2 degree decrease
  - <500 ml = minimal temperature change



# Pitfalls

- Supervisor not available for fluid administration
- What to do with the re-arrest patient?





# Results So Far

- ~27 patients considered for IH
  - 8 excluded
    - 4 contraindicated
    - 2 no supervisor/arrest en route
    - 2 re-arrest
- 19 patients induced pre-hospital +  
2 patients induced in-hospital =  
21 total patients with some  
hypothermia



# Why May This Work?

- Stated hypothermia mechanism to preserve neuro tissue
- MAP improvements due to cold fluid
- Marshal Isaac's "we don't \*&^% with them" theory



# Summary

- Induced hypothermia is a simple and safe intervention in the pre-hospital setting
- The hospital, departmental, and physician interactions create most of the pitfalls



[www.wakeems.com](http://www.wakeems.com)



# Citations

1. Wake CNTY EMS DATABASE
2. Edgren, E et al. Assessment of neurological prognosis of comatose survivors of cardiac arrest. *Lancet* 1994; 343:1055-59.
3. Myerburg, R et al. Clinical, electrophysiologic and hemodynamic profile of patients resuscitated from prehospital cardiac arrest. *Am J Med.* 1980; 68:568-76.
4. Hypothermia After Cardiac Arrest (HACA) Study Group. Mild therapeutic hypothermia to improve the neurologic outcome after cardiac arrest. *N Engl J Med.* 2002; 346:549-56.
5. Bernard, SA et al. Treatment of comatose survivors of out of hospital cardiac arrest with induced hypothermia. *N Engl J Med.* 2002; 346:557-63.
6. Yanagawa, Y, et al. Preliminary clinical outcome study of mild resuscitative hypothermia after out of hospital cardiopulmonary arrest. *Resuscitation* 1998; 36:61-66.
7. Bernard, SA, et al. Clinical trial of induced hypothermia in comatose survivors of out of hospital cardiac arrest. *Ann Emerg Med.* 1997;30:146-53.
8. Persse, DE et al. Managing the post-resuscitation patient in the field. *PEC* 2002;6:114-22.
9. Part 7.5: Postresuscitation Support. *Circulation* 2005;112:84-88.
10. Kollmar, R. Early effects of acid-base management during hypothermia on cerebral infarct volume, edema, and cerebral blood flow in acute focal cerebral ischemia in rats. *Anesthesiology* 2002;97:868-74.
11. Persse, D. Et al. Managing the post resuscitation patient in the field. *PEC* 2002;6:114-122
12. Leonov Y, et al. Hypertension with hemodilution prevents multifocal cerebral hypoperfusion after cardiac arrest in dogs. *Stroke.* 1992;23:45-53.
13. Sterz F, et al. Hypertension with or without hemodilution after cardiac arrest in dogs. *Stroke.* 1990;21:1178-84.
14. Kuboyama K, et al. Delay in cooling negates beneficial effects of mild resuscitative hypothermia after cardiac arrest in dogs. *Crit Care Med.* 1993;21:1348-58.
15. Markarian GZ, et al. Mild hypothermia:therapeutic window after experimental cerebral ischemia. *Neurosurgery* 1996, 38:542-551.
16. Nolan, JP. Therapeutic hypothermia after cardiac arrest: An advisory statement by the advanced life support task force of the international liaison committee on resuscitation. *Circulation* 2003;108:118-121.
17. Danzl DF. Accidental hypothermia. *N Engl J Med.* 1994;331:1756-60.
18. Patt, A. Effect of hypothermia induced coagulopathies in trauma. *Surg Lcin North Am.* 1988;68:775-85.
19. Roher MJ. Effect of hypothermia on the coagulation cascade. *Crit Care Med.* 1992; 20: 1402-05.
20. Valerie CR. Hypothermia induced platelet dysfunction *Ann Surg.* 1987;205:175-81.
21. Holzer M. Hypothermia for neuroprotection after cardiac arrest: Systematic review and individual patient data meta-analysis. *Crit Care Med* 2005; 33:414-18.