Hypothermia Protocols: A Focus on Bedside Application

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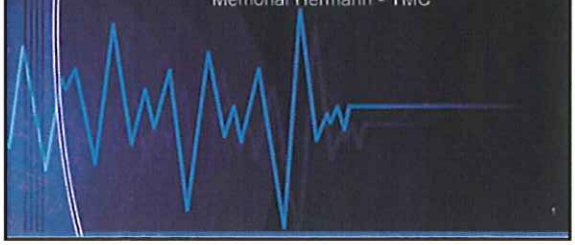

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Objectives

- Describe the benefits of induced hypothermia following cardiac arrest
- Discuss key logistical items that must be considered prior to implementation of hypothermia protocols in clinical practice

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Historical Perspective

Hippocrates - ~400 BC

Baron Dominque Larry - 1812

Temple Fay – 1937

Bigelow & McBirnie – 1953

Rosomoff & Gilbert – 1955

Benson - 1959

Chest 2008;133(5):1267-1274

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Therapeutic Hypothermia Today

- New England Journal of Medicine – 2002
  - 2 articles demonstrating improved outcomes in patients receiving therapeutic hypothermia
- Advisory Statement – 2003
  - American Heart Association (AHA) & International Liaison Committee on Resuscitation (ILCOR)
- ACLS Guidelines – 2010
  - Class I, LOE B
  - Class IIb, LOE B

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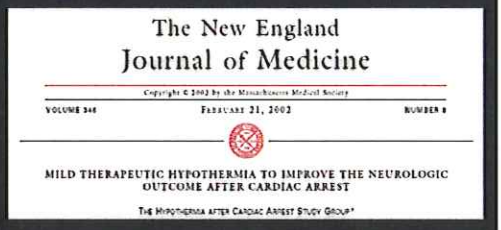
Benefits of Therapeutic Hypothermia



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MILD THERAPEUTIC HYPOTHERMIA TO IMPROVE THE NEUROLOGIC OUTCOME AFTER CARDIAC ARREST

THE HYPOTHERMIA AFTER CARDIAC ARREST STUDY GROUP*

N Engl J Med 2002; 346:549-556

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Benefits of Therapeutic Hypothermia

- Multi-center, blinded, randomized controlled trial
- Hypothermia for 24 hours (32°C to 34°C) versus normothermia
- Witnessed arrest, Vfib or pulseless Vtach arrest, unresponsive after ROSC
- Primary end-point: favorable neurologic outcome within 6 months of arrest

N Engl J Med 2002; 346:549-556

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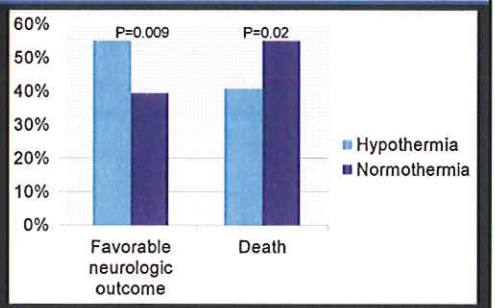
Benefits of Therapeutic Hypothermia



N Engl J Med 2002; 346:549-556 7

Benefits of Therapeutic Hypothermia

TREATMENT OF COMATOSE SURVIVORS OF OUT-OF-HOSPITAL CARDIAC ARREST WITH INDUCED HYPOTHERMIA

STEPHEN A. BERNARD, M.B., B.S., TAMORA W. GRAY, M.B., B.S., MICHAEL D. BUIST, M.B., B.S., BRUCE M. JONES, M.B., B.S., WILLIAM SILVESTER, M.B., B.S., GEOFF GUTTERIDGE, M.B., B.S., AND KAREN SMITH, B.Sc.

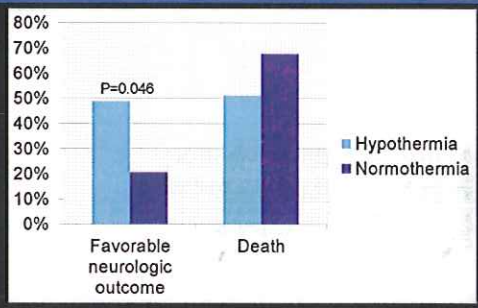
N Engl J Med 2002; 346:557-563 8

Benefits of Therapeutic Hypothermia

- Randomized controlled trial
- Hypothermia for 12 hours (33°C) versus normothermia
- Vfib arrest unresponsive after ROSC
- Primary end-point: survival to hospital discharge to home or SNF

N Engl J Med 2002; 346:557-563 9

Benefits of Therapeutic Hypothermia



N Engl J Med 2002; 346:557-563 10

BEDSIDE CONSIDERATIONS

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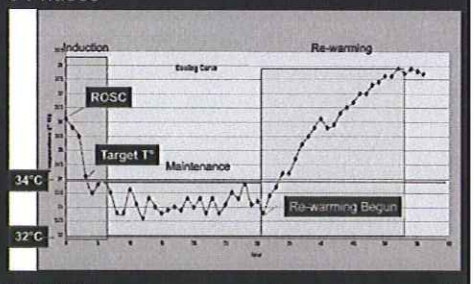
Achieving Target Temperatures

- 3 Phases



Chest. 2014;145(2):285-293. 12

Achieving Target Temperatures

Invasive Cooling	Non-Invasive Cooling
• Endovascular catheters	• Immersion devices
• ECMO	• Cooling pad / blanket devices
• Cold saline / fluid infusion	• Ice packs
Benefits:	
• Faster cooling	• Less invasive
• Improved temperature control	• Most can be initiated earlier
Risks:	
• Procedure needed for placement	• Slow or incomplete cooling
• Fluid volume	• May be cumbersome

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Depth and Duration of Hypothermia

- Duration of hypothermia
  - Generally accepted 12-24 hours
- Temperature goal
  - Generally accepted range from 32°C to 34°C
  - Side effects increase with the decrease in temperature
  - Targeted Temperature Management at 33°C versus 36°C After Cardiac Arrest

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Depth and Duration of Hypothermia

THE NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Targeted Temperature Management at 33°C versus 36°C after Cardiac Arrest

N Engl J Med 2013;369:2197-206.

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Depth and Duration of Hypothermia

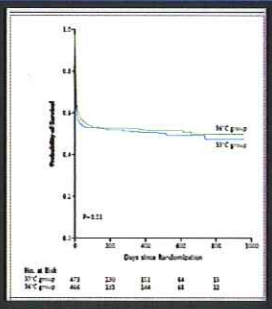
- Randomized controlled trial
- Hypothermia for 28 hours at 33°C versus 36°C
- Out –of-hospital arrest unresponsive after ROSC with 20 minutes sustained ROSC
- Primary end-point: all cause mortality through the end of the trial

Depth and Duration of Hypothermia

Table 2. Outcomes.

Outcome	33°C Group	36°C Group	Hazard Ratio or Risk Ratio (95% CI)*	P Value
	no./total no. (%)			
Primary outcome: deaths at end of trial	235/473 (50)	225/466 (48)	1.06 (0.89–1.28)	0.51
Secondary outcomes				
Neurologic function at follow-up†				
CPC of 3–5	251/469 (54)	242/464 (52)	1.02 (0.88–1.16)	0.78
Modified Rankin scale score of 4–6	245/469 (52)	239/464 (52)	1.01 (0.89–1.14)	0.87
Deaths at 180 days	226/473 (48)	220/466 (47)	1.01 (0.87–1.15)	0.92

Depth and Duration of Hypothermia



Maintaining Target Temperatures

- Shivering
  - Bedside Shivering Assessment Scale
    - 0 **None**: no shivering noted on palpation of the masseter neck or chest wall
    - 1 **Mild**: shivering localized to the neck and/or thorax
    - 2 **Moderate**: shivering involves gross movement of the upper extremities
    - 3 **Severe**: shivering involves gross movements of the trunk and upper and lower extremities

Stroke. 2006;39:3242-3247.
J Cardiovasc Med 2014; 15:000–000

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Maintaining Target Temperatures

- Pharmacologic agents
  - Paralytics
    - Continuous infusion vs bolus dosing
    - Mask seizure symptoms
  - Sedation & Analgesia
  - Meperidine
  - Acetaminophen

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Assessment Question

- What is the primary benefit of induced hypothermia after cardiac arrest?

a. Improved neurological outcome
b. Reduced myocardial damage
c. Decreased incidence of acute kidney failure
d. Avoidance of shock

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