Hypothermia Protocols: A Focus on Bedside Application
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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

Historical Perspective
- Hippocrates - 400 BC
  - Temple Fay - 1917
  - Bigelow & McCreary - 1953
  - Resnoff & Gibert - 1955
  - Benson - 1959
  - Baron Dominique Larrey - 1812

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

The New England Journal of Medicine

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

Achieving Target Temperatures

- 3 Phases
  - Re-warming
  - Maintenance
  - Brady-gone
  - ROSC

BEDSIDE CONSIDERATIONS
Achieving Target Temperatures

<table>
<thead>
<tr>
<th>Invasive Cooling</th>
<th>Non-Invasive Cooling</th>
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<tbody>
<tr>
<td>• Endovascular catheters</td>
<td>• Immersion devices</td>
</tr>
<tr>
<td>• ECMO</td>
<td>• Cooling pad / blanket devices</td>
</tr>
<tr>
<td>• Cold saline / fluid infusion</td>
<td>• Ice packs</td>
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</tbody>
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Benefits:
• Faster cooling
• Improved temperature control

Risks:
• Procedure needed for placement
• Sore or complete cooling
• May be cumbersome

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

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>
<thead>
<tr>
<th>Primary outcomes</th>
<th>33°C Group</th>
<th>36°C Group</th>
<th>Hazard Ratio in Died vs Survived</th>
<th>P value</th>
</tr>
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<tbody>
<tr>
<td>Primary outcome: death of trial</td>
<td>219 (17%)</td>
<td>221 (18%)</td>
<td>1.06 (0.91-1.25)</td>
<td>0.51</td>
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</tbody>
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Secondary outcomes:
- Neurological deficit at 90 days
  - 106 (12.1%) vs 106 (12.1%) (P = 0.88)
- Partial neurological deficit at 90 days
  - 104 (12.1%) vs 104 (12.1%) (P = 0.88)
- Derived 100 days
  - 226 (17.9%) vs 226 (17.9%) (P = 0.65)
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

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

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