



Prehospital Therapeutic Hypothermia

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**“Hypothermia is one of the best studied
and most highly effective modes of
neuroprotection.”**

Bath P. Re: Stroke Therapy Academic Industry roundtable II (STAIR-II). Stroke. 202;33:639-640

What is Therapeutic Hypothermia?



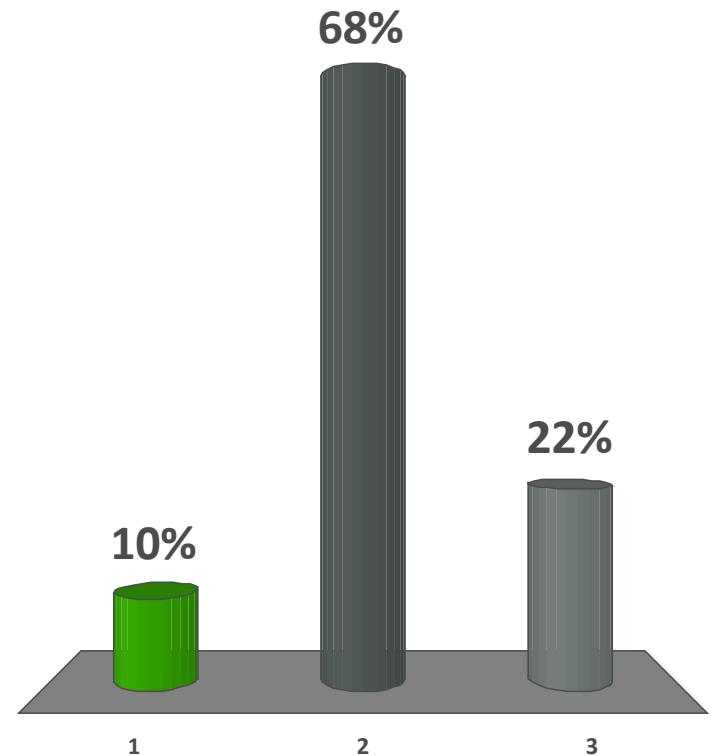
- Medical treatment that lowers body temperature in order to reduce the risk of ischemic injury to tissue
- Classification
 - **Severe $<28^{\circ}\text{C}$**
 - **Moderate 28°C to 34°C**
 - **Mild 34°C to 36°C**

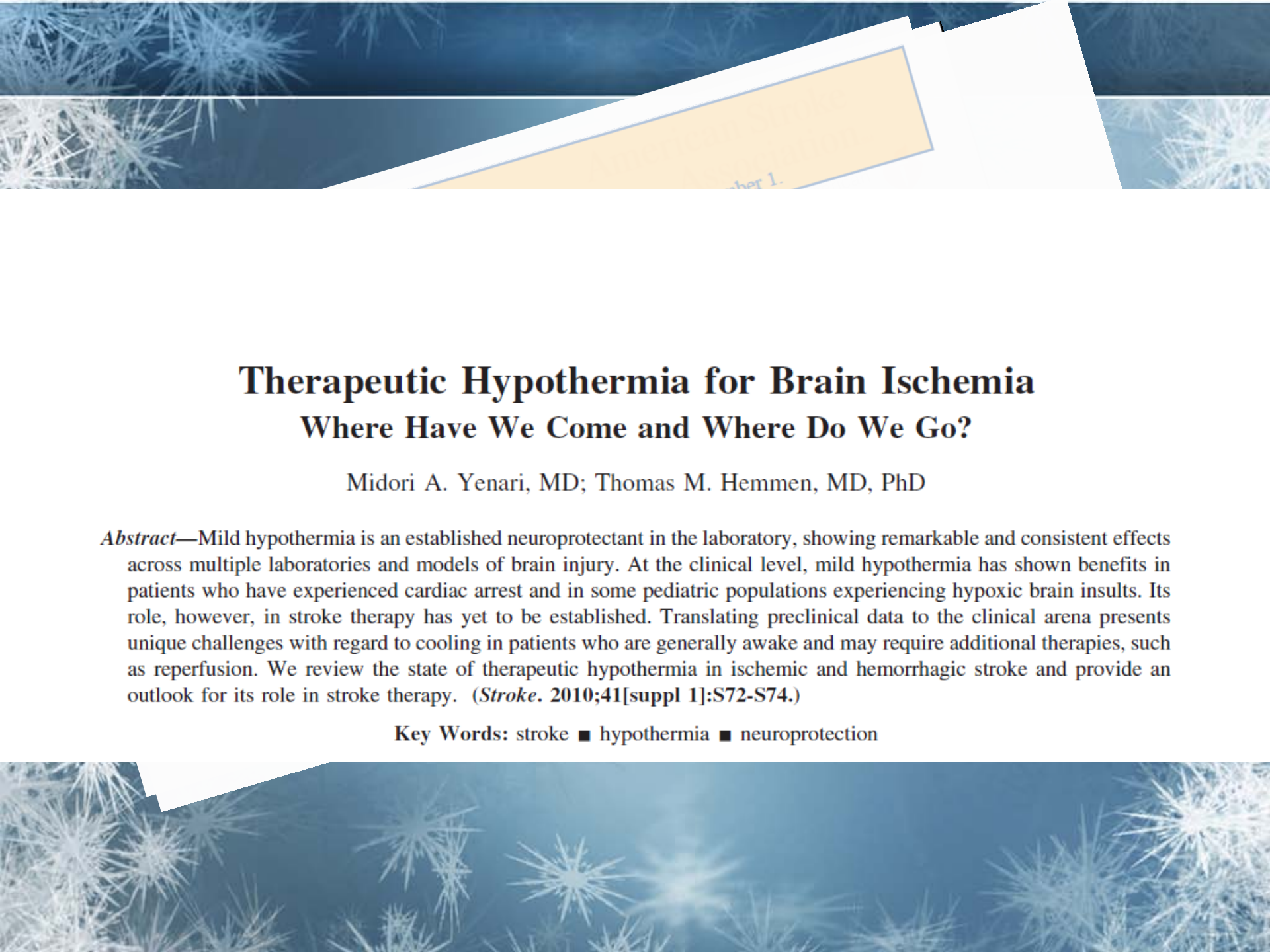
Lyden PD, Krieger D, Yenari M, Dietrich WD. Therapeutic hypothermia for acute stroke, Int J Stroke. 2006;1:9-19



In animal studies, which classification of hypothermia has been proven to be the most neuroprotective?

1. Severe $<28^{\circ}\text{C}$
2. Moderate 28°C to 34°C
3. Mild 34°C to 36°C





Therapeutic Hypothermia for Brain Ischemia

Where Have We Come and Where Do We Go?

Midori A. Yenari, MD; Thomas M. Hemmen, MD, PhD

Abstract—Mild hypothermia is an established neuroprotectant in the laboratory, showing remarkable and consistent effects across multiple laboratories and models of brain injury. At the clinical level, mild hypothermia has shown benefits in patients who have experienced cardiac arrest and in some pediatric populations experiencing hypoxic brain insults. Its role, however, in stroke therapy has yet to be established. Translating preclinical data to the clinical arena presents unique challenges with regard to cooling in patients who are generally awake and may require additional therapies, such as reperfusion. We review the state of therapeutic hypothermia in ischemic and hemorrhagic stroke and provide an outlook for its role in stroke therapy. (*Stroke*. 2010;41[suppl 1]:S72-S74.)

Key Words: stroke ■ hypothermia ■ neuroprotection



Neuroprotective Action

- Decreases cerebral metabolic rates
 - Glucose and oxygen
- Slows ATP breakdown
- Reduces oxygen consumption
- Limits edema
- Interrupts necrosis

Hemmen TM, Lyden PD. Induced hypothermia for acute stroke. *Stroke*. 2007;38:794 –799



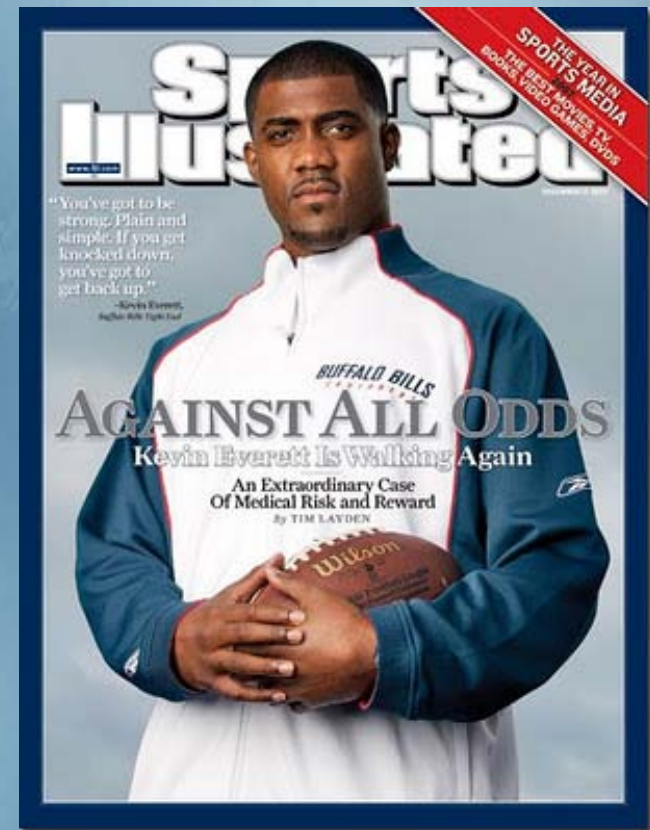
Why EMS?

“Time to cooling is another factor because it is well known that earlier treatment increases the chances of a good outcome.”

Yenari M. A., Hemmen T. M. (2010). Therapeutic hypothermia for brain ischemia: where have we come and where do we go? *Stroke* 41(Suppl. 10), S72–S74.

Possible Clinical Uses

- Intra-cardiac arrest
- Post-cardiac arrest (ROSC)
- Traumatic brain injury
- Neonatal hypoxic-ischemic encephalopathy
- ST-elevation myocardial infarction
- Ischemic stroke





ILCOR Advisory Statement

Therapeutic Hypothermia After Cardiac Arrest **An Advisory Statement by the Advanced Life Support Task Force of the** **International Liaison Committee on Resuscitation**

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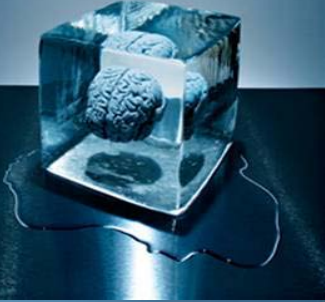
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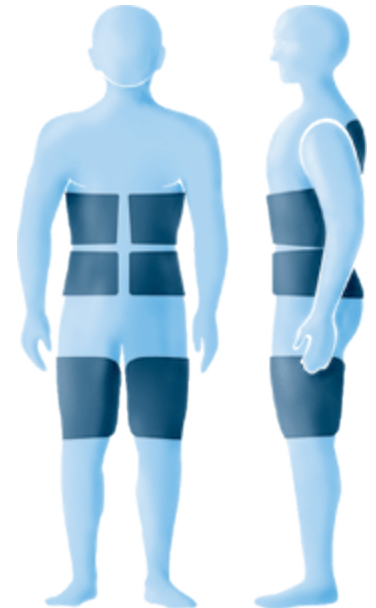
Prehospital Limitations

- Staffing
- Scope of practice
- Power
- Size



Conventional Prehospital Options

- Surface cooling
 - Axilla
 - Chest
 - Groin
- Cold Intravenous Saline
 - Bolus
 - Infusion



Standard Cooler

- **Benefits:**
 - Simple
 - Low cost
 - Durable
- **Disadvantages:**
 - Requires active employee involvement
 - Temperature variation



Will it Work?

- Saline pre-cooled to 2 C
- Picnic cooler with reusable ice packs
- Time it took fluid to warm to 4 C
 - @25 C ambient = 29:53
 - @50 C ambient = 10:50

Electric Cooler

- **Benefits:**
 - Accurate
 - Temperature control
 - Adjustable
- **Disadvantages:**
 - \$\$\$\$
 - Power





Life Core Technologies' Excel Cerebral Cooling System

- Non-invasive
- Simple use
- Carotid triangle







RhinoChill™ IntraNasal Cooling System

- Utilizes:
 - Liquid coolant
 - Nebulized oxygen
- Introduced via catheter into nasal cavity
- Brain cooled through direct conduction
- No shivering initially



Stroke

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A Division of American
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**Local Brain Temperature Reduction Through Intranasal Cooling With the
RhinoChill Device : Preliminary Safety Data in Brain-Injured Patients**
Alex Abou-Chebl, Gene Sung, Denise Barbut and Michel Torbey

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Cooling Helmets

- Cool the brain prior to the body
- Easy prehospital use
- More efficient than ice packs



CoolSystems, Inc

Pharmacological Intervention



Fosgerau et al. *BMC Cardiovascular Disorders* 2010, **10**:51
<http://www.biomedcentral.com/1471-2261/10/51>



RESEARCH ARTICLE

Open Access

Drug-induced mild therapeutic hypothermia obtained by administration of a transient receptor potential vanilloid type 1 agonist

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Questions ?



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