

The Bedside Report

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Ice Ice Baby: An Overview of Targeted Temperature Management

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Targeted temperature management (TTM) is the process of achieving and maintaining a specific body temperature range, typically between 32°C and 36°C, for a pre-specified duration of time after a patient has experienced an acute ischemic event. This therapy is postulated to decrease the metabolic demand of the brain, thus preserving neurologic tissue and leading to improved clinical outcomes after cardiac arrest in unresponsive patients as well as in patients who have experienced a traumatic brain injury, meningitis, acute liver failure, and stroke.^{1,2} The most recent American Heart Association (AHA) guidelines recommend the use of TTM, or therapeutic hypothermia, for all comatose patients after return of spontaneous circulation

(ROSC) following cardiac arrest regardless of initial rhythm or if the cardiac event occurred outside or within the hospital.³ Furthermore, AHA recommends selecting a constant target temperature between 32°C and 36°C and to maintain that set temperature for a minimum of 24 hours.³ Adult, comatose patients (as defined by a Glasgow Coma Scale < 8) are eligible for TTM at AU Health under three circumstances, as outlined in Table 1. Furthermore, absolute and relative contraindications should be considered prior to initiation as outlined in Table 2.

Table 1. Indications for TTM at AU Health

Indication	Target Temperature	Duration of TTM	Considerations
Post-cardiac arrest	32°C to 34°C	At least 24 hours	TTM must be initiated within 8 hours of ROSC
Refractory intracranial pressure (ICP) elevation	32°C to 34°C	At least 48 hours	Consider as a Tier 3 option
Refractory status epilepticus (RSE)	32°C	At least 24 hours	Requires discussion with Neurology / Neurosurgery prior to initiation if patient is outside of the neuro ICU

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Table 2. Contraindications for TTM

Absolute Contraindications	Relative Contraindications
DNR/DNI designation	Pregnancy
Hospice patients	Pre-event terminal conditions that shorten life expectancy < 6 months
Cases of prolonged CPR > 60 minutes	Active bleeding or known pre-existing coagulopathy
ROSC achieved > 8 hours before initiation	Refractory hypotension
Post-arrest temperature < 30°C	Sepsis
Patient is awake and able to obey verbal commands	

A common adverse effect of TTM is shivering, which can cause a significant decrease in brain tissue oxygen tension – this leads to metabolic stress and potentially eliminates the benefits of TTM.⁵ Because of this, one of the most important aspects of the TTM induction phase is shivering prevention. At the induction of therapeutic hypothermia, acetaminophen, buspirone, and magnesium should be initiated or the prevention of shivering along with continuous EEG monitoring as outlined in Figure 1. Analgesia and sedation should be used to target a RASS of -3 to -4.

Figure 1. Shivering Prophylaxis Protocol

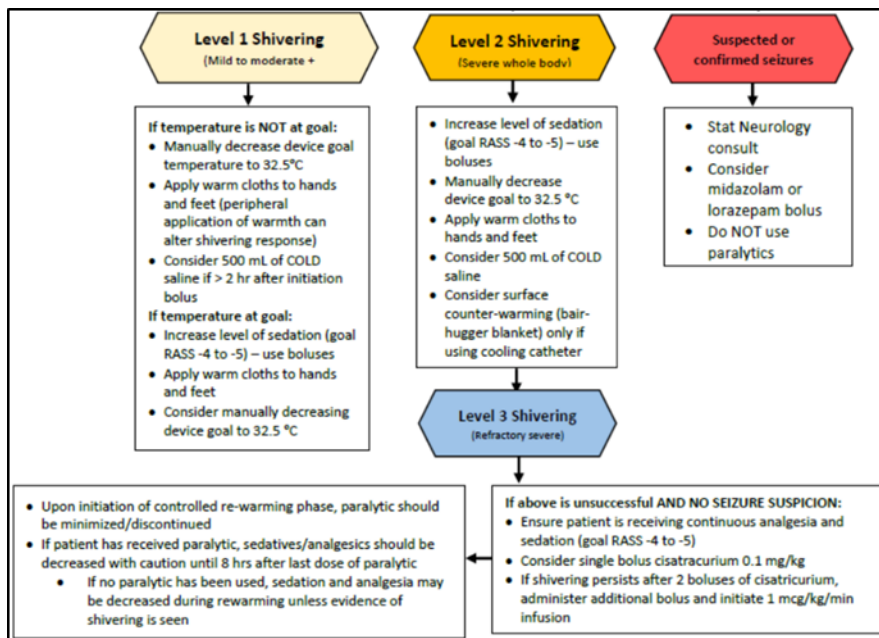
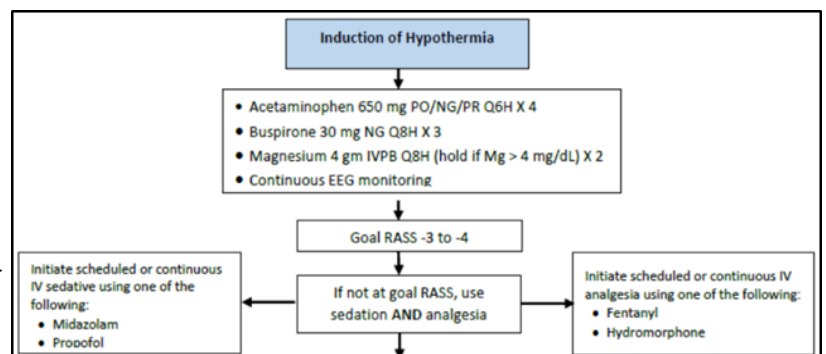


Figure 2. Shivering Treatment Protocol

On the other hand, treatment options for shivering vary depending on the severity and are outlined in Figure 2. Mild to moderate shivering (Level 1) treatment depends on if the target temperature is at goal or not. Options include applying warm cloths peripherally to hands and feet, administration of cold saline, increasing the level of sedation, and/or manually decreasing the device goal temperature to 32.5°C. Severe, whole body shivering (Level 2) treatment options include the same as Level 1 with the addition of the use of surface counter-warming if using a cooling catheter. Refractory severe shivering (Level 3) patients should receive increased sedation and can consider the use of cisatracurium.

Ice Ice Baby: An Overview of Targeted Temperature Management Cont.

There are extensive monitoring parameters during the maintenance phase of TTM that include continuous core temperature monitoring, continuous telemetry monitoring, and daily EKG. Potassium levels should be checked **prior to TTM** initiation, repleted per protocol, and hypothermia should be delayed until serum K > 3 mEq/L. Potassium should be monitored every 4 hours **during TTM** maintenance and should be repleted according to Table 3. Note that potassium repletion goals are lower once cooling is initiated due to the common risk of hyperkalemia during the rewarming phase. Rewarming should be considered 24 hours after the patient has reached target temperature for post-cardiac arrest and RSE patients, and 48 hours after achievement of target temperature for refractory ICP elevation patients.

Table 3. Potassium Repletion **During TTM**

Potassium Level	Repletion
> 3.5 mEq/L	Do not replete
3 – 3.4 mEq/L	Replete with KCl 20 mEq
< 3 mEq/L	Replete with 2 doses of KCl 20 mEq (40 mEq total)



Electrolyte replacement varies based on the TTM phase! Ensure use of the correct electrolyte replacement protocols, based on the TTM status!

TTM is the only intervention that has been demonstrated to improve neurologic recovery after cardiac arrest.³ At AU Health, TTM should be considered for all unresponsive post-cardiac arrest adult patients who have achieved ROSC within the last 8 hours, as well as in certain cases of refractory ICP elevation and RSE.

Eligibility requirements, contraindications, monitoring parameters, electrolyte repletion parameters (pre and during TTM), and the shivering prevention protocol can all be found in the full guideline “Adult Targeted Temperature Management (TTPM) Protocol.”

Utilizing the PowerPlan: *Targeted Temperature Management (Hypothermia) Adult, Pre-Cooling and Induction* will help ensure orders, including monitoring parameters and medications, are ordered correctly and timely!

References

1. Deye N, Cariou A, Girardie P, et al. Endovascular Versus External Targeted Temperature Management for Patients with Out-of-Hospital Cardiac Arrest: A Randomized, Controlled Study. *Circulation*. 2015;132:182-193.
2. Saigal S, Sharma JP, Dhurwe R, et al. Targeted temperature management: Current evidence and practices in critical care. *Indian J Crit Care Med*. 2015;19(9):537-546. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4578199/>
3. Donnino MW, Anderson LW, Berg KM, et al. Temperature Management After Cardiac Arrest. *Circulation*. 2015;132:2448-56. <https://www.ahajournals.org/doi/full/10.1161/CIR.0000000000000313>
4. AU Health Adult Targeted Temperature Management (TTM) Protocol. 2017.
5. Jain A, Gray M, Slisz S, et al. Shivering Treatments for Targeted Temperature Management: A Review. *J Neurosci Nurs*. 2018;50(2):63-7.

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