

Guideline for Targeted Temperature Management after Cardiac Arrest

Guideline Committee:

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Inclusion Criteria¹

- 18 yrs. or older comatose patients^{2,3}
- Return of spontaneous circulation (ROSC)
- Arrest Rhythm:
 - Out of hospital arrest or transfers⁴ – All initial rhythms
 - In-hospital arrest – ventricular fibrillation or ventricular tachycardia
 - Emergency Department arrests⁵
 - <30 min. since ED arrival – all rhythms
 - >30 min. since ED arrival – ventricular fibrillation, ventricular tachycardia, ED attending discretion

Exclusion Criteria

- Unstable cardiac rhythm or persistent hemodynamic instability despite therapy
- Severe trauma or bleeding
 - If traumatic intracranial bleeding is suspected, a non-contrast head CT should be performed immediately to rule out intracranial hemorrhage prior to the start of targeted temperature management
- Severe systemic infection or sepsis
- Pregnancy
- Significant burns prior to or subsequent to the cardiac arrest
- DNR/DNI
- CPR or pulseless for > 60 minutes
- Major surgery within the last 14 days
- Alternative cause of unresponsiveness suspected, i.e. drug overdose, intoxication
- Active bleeding
- More than 8 hours elapsed since ROSC (it is generally accepted that earlier initiation of therapy is likely associated with improved outcomes).

Goals & Treatment Timeline

- Initiate targeted temperature management (TTM) with the goal of initiating treatment within 4 hours of ROSC and achieving a target temperature of 36° C (96.8° F) within 4 hours of initiation and sustained for 24 hrs.
- Other treatment interventions (i.e. cardiac cath) should be simultaneously pursued as indicated. If in conflict, cardiac revascularization takes precedence over hypothermia implementation.
- 24 hours after achieving target temperature, return to normothermia is initiated with a new target temperature of 37° C (98.6° F). Maintain temperature 37° C ±0.5° C (<99.5° F) for the next 48 hours, strictly avoiding hyperthermia.

¹ When possible, treatment should begin in the ED at the discretion of the attending Emergency Physician.

² Comatose defined by the attending Emergency Physician as not obeying any verbal command and **GCS motor score of equal to or less than 3** prior to initiation of targeted temperature management where the patient has not received in-hospital sedation or prehospital sedation that is clinically suspected to impair this evaluation

³ For inpatient or ED arrests – mental status should be defined 15 minutes post-arrest

⁴ For ED to ED transfers – initiation of treatment is at the discretion of the responsible Lifepact attending or accepting attending physician

⁵ Initiation of hypothermia in ED arrests based on timing of the ED arrest is ultimately at the discretion of the treating ED attending physician

Pre-Induction Preparation

- Discuss care plan with healthcare proxy
- Document neurological exam and presenting GCS (Glasgow Coma Scale).
- Select and follow TTM (Targeted Temperature Management) Orderset.
- Once the decision is made to perform targeted temperature management, patients must be intubated. Sedation and analgesia are not mandatory and are to be used when clinically indicated.
- Shivering should be managed using the shivering protocol (See appendix A)
- If patient is hypothermic on arrival, monitor core temperature q30m. Begin to warm the patient to 36° if core temp reaches 32°C, otherwise continue to monitor and do not actively warm the patient. Consider the 24 hour start time for TTM maintenance phase as the time of ED arrival.
- Note: A STAT noncontrast head CT is required prior to initiation of hypothermia *only* if there is suspicion of traumatic intracranial hemorrhage

Induction Procedure:

A. Workup

- Select TTM (Targeted Temperature Management) Order set from Epic
- Required Orders: CBC, Chem 10, CPK, Troponin I, VBG, Lactic Acid, PT/PTT/INR, D-dimer, fibrinogen, LFTs, Lipase, Urinalysis, Drugs of Abuse, B HCG (women of childbearing age), EKG, Chest X-Ray.

B. Induction of TTM

- Non-pharmacologic Management
 - i. Perform and document skin assessment prior to application of cooling device
 - ii. Apply cooling device to initiate TTM
 1. Rate: Maximum rate of device
 2. Target: 36°C.
- Pharmacologic Management
 - i. If shivering anticipated, initiate Shiver Protocol (see appendix A)
 - ii. Order sedation protocol to achieve sedation goals

C. Lines and Catheters

- Foley
- Oralgastric Tube
- Rectal or esophageal temperature probe
- Triple Lumen subclavian or internal jugular central venous access with CVP, if clinically indicated (additional consideration of femoral access in patients to receive IIB-IIIa inhibitors)
- Arterial Catheter, if clinically indicated (in the ICU, at ICU discretion. NOTE: This is neither required before nor should it hinder the induction process)

D. Monitoring

- Document core temperature every 30 minutes while attempting to achieve 36°C
- Monitor vitals and rhythm closely during this phase. Arrhythmias may occur. Bradycardia is common.
- If severe dysrhythmias, hemodynamic instability, or bleeding develop, attempting target temperature of 36°C should be discontinued and patient should be maintained at 37°C.

E. Mechanical Ventilation

- As per normal ICU practice depending upon patient history and pathophysiology
- Hyperventilation to targeted PaCO₂ levels is not recommended

F. Disposition

- At Rhode Island Hospital:
 - i. Immediately Contact Fellow to facilitate disposition

1. MICU – 952-6464
2. CCU – page the CCU fellow
- ii. Admit to the CCU
 1. STEMI on Emergency Department ECG
 2. Ventricular tachycardia or ventricular fibrillation as initial out of hospital rhythm
 3. Clinical presentation associated with high suspicion for ACS following cardiology consultation
- iii. Admit to the MICU - PEA or aystole as initial out of hospital rhythm
- At The Miriam Hospital: Consultation on a case-by-case basis
- At Newport Hospital:
 - i. For STEMI patients
 1. Immediately contact LifePact or STAT Southcoast for transfer to RIH/TMH
 2. Contact the Lifespan Transfer center
 - ii. For non-STEMI patients – admit to the ICU (provided there is ICU capacity)

Maintenance Procedure:

- A. Physical Exam
 - a. Maintain MAP \geq 60 mmHg
 - b. Vasoconstriction-mediated hypertension can occur and may be neuroprotective. Determine goal MAP by balancing cardiac treatment outcomes with the theoretical advantage of higher cerebral perfusion pressure.
- B. Laboratory Workup
 - a. Refer to TTM (Targeted Temperature Management) order set from POM for supportive therapy as well as for mandatory bloodwork.
 - b. Minimum requirements include:
 - Daily CBC, PT, PTT, INR
 - BMP, Mg, CBC, and ABG per provider discretion
- C. Maintenance of TTM
 - a. Target temperature 36°C
 - b. Maintain temperature \pm 0.5°C of target
 - c. Duration of target temperature 36°C.: 24 hours after 36°C is achieved
 - d. Document core temperature every hour.
- D. Nutrition, Fluid, Electrolyte Balance
 - a. Check electrolytes frequently and replete as necessary during the induction and maintenance phases.
 - b. Check skin integrity every 2 hrs, particularly at sites of contact with cooling surfaces.
 - c. Enteral feeds at the discretion of the provider

Return to normothermia (37°C) Procedure:

- A. Hemodynamics
 - a. Maintain MAP $>$ 60 mmHg – monitor for vasodilation-mediated hypotension
- B. Fluid & Electrolyte Management prior to return to normothermia
 - a. Volume load to compensate for reductions in CVP or MAP
- C. Return to normothermia with external cooling device
 - a. Target temperature 37°C
 - b. Rate 0.5°C/hr.
 - c. Maintain strict normothermia (37° C) for the next 48 hrs after return to normothermia complete
 - d. Analgesia and sedation per Care Unit protocol.
 - e. Extubate as per Care Unit protocol.

Early Termination of Protocol:

For patients who have suffered PEA or asystolic arrests, if it is judged by the attending that continuation of the therapeutic hypothermia would be futile secondary to concurrent organ dysfunction, severe comorbidities, or escalating hemodynamic instability such that one year survival is unlikely, then the protocol may be terminated prior to 72 hours.

For patients who awaken and follow commands during targeted temperature management, begin return to normothermia and maintain strict normothermia ($37^{\circ}\text{C} \pm 0.5^{\circ}\text{C}$) for the next 48 hours using the cooling device when necessary.

Prognosis:

Neurologic prognosis of the comatose cardiac arrest survivor after therapeutic hypothermia cannot be reliably predicted until at least 72 hours after return to normothermia. Therefore, it is recommended that a new DNR status should not be established and care should not be withdrawn *based on neurologic prognosis* before 72 hours after return to normothermia. If 72 hours after return to normothermia the patient remains comatose, consider Neurology consultation for neuroprognostication. Sending a neuron specific enolase can be considered on days 1-3 after cardiac arrest to aid in neuroprognostication. MRI brain without gadolinium on days 3-5 can also be considered to aid in neuroprognostication. Noncontrast head CT 48 hours post-arrest can be obtained if MRI brain is not possible.

Adult Critical Care Shivering Protocol

Prior to initiation:

- Ensure magnesium level at goal (at least > 2 mEq/L)
- Start acetaminophen 650 mg PO/OGT/NGT/PR every 4 hours (if not already ordered)

Once patient is placed on a cooling device, initiate all the following:

- Bedside Shivering Assessment Score (BSAS) (see Shivering Monitoring)
- Bair-Hugger blanket on high setting
- Buspirone 30 mg PO/NGT/OGT q8h

If BSAS >1, give meperidine 25 mg IV every 6 hours prn BSAS > 1

In 30 minutes, if BSAS remains > 1, contact APP/MD to consider the following:

- Clonidine 0.1 mg PO/NGT/OGT q8h **AND/OR**
- Dexmedetomidine IV continuous infusion, initiate at 0.2 mcg/kg/hr, no bolus dose (max dose 1.5 mcg/kg/hr) **AND/OR**
- Propofol IV continuous infusion, initiate at 10 mcg/kg/min or increase by 5 mcg/kg/min if already on propofol (max dose 80 mcg/kg/min)

AND

- Goal magnesium level 3-4 mEq/L

If refractory shivering, neuromuscular blockade can be considered at the discretion of the attending intensivist or cardiology fellow (CCU only) in mechanically ventilated patients. Ensure deep sedation and adequate analgesia prior to and during neuromuscular blockade usage.

DISCONTINUE SHIVERING PROTOCOL once the patient is off the Normothermia/Targeted Temperature Management Protocol

Shivering Monitoring

Assess Bedside Shivering Assessment Score (BSAS)

- Every 30 min until patient at target temperature and BSAS at goal 0-1
- Assess BSAS every 1 hour once at goal

Bedside Shivering Assessment Scale (BSAS)

Score	Description
0	No shivering noted on palpation of the jaw (masseter muscle), neck or chest wall
1	Shivering of the jaw, neck or chest wall
2	Shivering of the shoulders or arms (biceps muscle) in addition to the jaw, neck and chest wall
3	Shivering of the legs (quadriceps muscle) in addition to the jaw, neck, chest wall and arms