LOS ANGELES COUNTY DEPARTMENT OF HEALTH SERVICES
HARBOR-UCLA MEDICAL CENTER

SUBJECT: TARGETED TEMPERATURE MANAGEMENT AND POST-ARREST CARE **POLICY NO.** 321B

CATEGORY: Provision of Care	**EFFECTIVE DATE:** 3/11
POLICY CONTACT: Dawna Willsey	**UPDATE/REVISION DATE:** 5/23
REVIEWED BY COMMITTEE(S): Hospital Critical Care	

PURPOSE:
To establish procedures at Harbor-UCLA Medical Center for Targeted Temperature Management (TTM) in eligible patients following cardiac arrest (CA) with return of spontaneous circulation (ROSC) in an effort to improve neurologic outcome by utilizing TTM for neuroprotection. TTM, including fever avoidance, is the only intervention that has been shown to improve neurologic outcome post-cardiac arrest. Fever post-ROSC is associated with poor outcome. In addition, this policy will address TTM for other clinical conditions.

DEFINITIONS:
Closed loop cooling device: Device that receives patient temperature input and adjusts device temperature automatically to achieve and maintain goal patient temperature as ordered.

POLICY:
In compliance with local governing policy (Los Angeles County STEMI Receiving Center (SRC), and national American Heart Association and International Liaison Committee on Resuscitation guidelines, Harbor-UCLA Medical Center staff shall:

- Evaluate all adult patients with ROSC post-CA for appropriateness of TTM;
- Perform this evaluation in the Emergency Department, Cardiac Catheterization Laboratory and/or Intensive Care Units.

This policy does not apply to targeted temperature management or cooling of neonatal patients (see separate policy).
TTM may be recommended for other clinical conditions. Attending physician preference for temperature goal may be ordered where appropriate.

PROCEDURE:
I. IDENTIFICATION OF TARGETED TEMPERATURE MANAGEMENT CANDIDATES
Patients who experience ROSC after CA but are comatose, defined as lack of command following

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APPROVED BY:

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Nina J. Park, MD
Interim Chief Executive Officer

Griselda Gutierrez

Griselda Gutierrez, MD
Chief Medical Officer

Jason Black

Jason Black, MBA, DNP, RN
Chief Nursing Officer

after ROSC, should be evaluated for treatment with TTM. Inclusion/exclusion criteria are delineated in the Targeted Temperature Management order sets available at Harbor-UCLA Medical Center.

Inclusion criteria include:

- Cardiac arrest, either in-hospital or out of hospital, regardless of initial rhythm
- Return of spontaneous circulation (ROSC) for > 20 minutes
- Patient is comatose (absence of command following) after ROSC
- Patient is intubated and receiving mechanical ventilation

For patients who achieve ROSC after a Cardiac Arrest, suggested default setting is 35ºC; per provider preference the temperature may be set 32-37.5°C per current guidelines. The need for percutaneous coronary intervention (PCI) should not affect decision to initiate TTM as it is well described to be safe when used concurrently in this population.

As with all medical therapies, the physician should assess risks vs. benefits and make a clinical decision when confronted with the following:

- Pre-existing coma prior to cardiac arrest
- Severe hypothermia at presentation
- Known terminal illness with comfort care planned
- Severe hemorrhage

II. PROVISION OF TARGETED TEMPERATURE MANAGEMENT: Post-Cardiac Arrest

Harbor-UCLA Medical Center Nursing and Physician staff will initiate and maintain TTM at locations including the Emergency Department, Cardiac Catheterization Laboratory, Adult Intensive Care Unit and Pediatric Intensive Care Unit, and will:

- Begin induction of TTM as soon as possible post-ROSC. Do not delay for transfer, PCI, or other indication.
- Maintain target temperature for 24 hours, followed by controlled rewarming and 48 hours of normothermia (<37.5°C goal). Strict fever avoidance is maintained for duration of TTM (72 hours).
- Utilize a cooling device with closed loop function only (Arctic Sun if available, or Blanketrol with auto mode) as soon as feasible.
    - If Arctic Sun is in use by another patient and there is an extenuating circumstance to reallocate, this may be escalated for consideration.
- Assess, review and document clinical, hemodynamic, core temperature, and laboratory monitoring throughout all phases of TTM as described in the order sets. In addition, staff will use sedatives and paralytics during treatment as delineated herein.

A. Induction Phase

1. Physicians should use the Targeted Temperature Management Order Set to place provider orders.
2. Cooling modalities should be initiated immediately upon provider orders, with time of induction initiation recorded in the nursing record.
3. Nursing staff should set desired target temperature of cooling devices to temperature

specified in provider orders. For patients who achieve ROSC after CA the goal temperature will default to 35°C, but providers may select a different temperature in range of 32-37.5°C. (See **Appendix A**).

4. Continuous temperature monitoring should be performed via core temperature monitor (foley or esophageal preferred, alternatively rectal). Core temperature input must be connected to cooling device in order to operate as a closed loop system.
5. Nursing staff shall record temperature and vital signs, and send labs, as per provider orders.
6. Goal temperature should be met by 4 hours after initiation, nursing staff to notify provider if goal not met.
7. Nursing staff shall initiate shivering assessment utilizing the BSAS rating scale hourly and notify provider for shivering.

B. **Maintenance Phase**

1. Maintain patient temperature at ordered goal temperature for 24 hours.
2. Continue to perform temperature, monitoring, vital signs, shivering assessment, and lab studies as per provider orders.
3. Sedative and paralytic medications will be used to control shivering and effectively perform TTM in a tiered treatment approach (see Appendix B for suggested management).
4. Obtain Neuron Specific Enolase (NSE) serum study at 24 hrs post ROSC if ordered.
5. Consider continuous EEG monitoring to evaluate for seizures. Limited hatband EEG may be used if conventional EEG is unavailable per policy.
6. MAP goal maintained >70mmHg or per provider orders.
7. Serum blood glucose maintained 100-200 mg/dl.
8. Electrolyte repletion as needed to goal.

C. **Rewarming Phase**

1. Following completion of the maintenance phase, initiate rewarming measures in accordance with provider orders.
2. Rewarming should be performed with strict temperature monitoring to avoid rewarming rate >0.25°C per hour. This should be accomplished with ongoing closed-loop temperature device.
    - Arctic Sun device has automatic program for rewarming, do not turn off device.
    - Blanketrol should be continued to be used in auto-mode.
3. Manage shivering and continue to document per protocol during rewarming phase.
4. When patient temperature reaches 36.5°C, discontinue neuromuscular blocking medications (paralytic agents) and wean sedation as appropriate.
5. If temperature > 37.5°C at any time, call provider. Fever in the immediate post-arrest cooling period should be avoided.

D. **Normothermia Phase**

1. Maintain goal normothermia temperature <37.5°C for 48 hours, continue cooling device as needed.
2. If temperature is <36.5°C after 12 hours, actively rewarm at a rate of 0.25°C per hour.
3. Continue strict fever avoidance.
4. Obtain remaining serial NSE at 48 hrs and 72 hrs post-ROSC if ordered.

III. NEUROLOGIC EVALUATION AND PROGNOSTICATION POST CARDIAC ARREST (ADULTS ONLY)

The primary patient care providers (faculty and house-staff physicians) shall involve the Department of Neurology physicians for specialist neurologic evaluation, assessment, and prognostication as appropriate. This can include evaluation for determination of comatose state following ROSC to initiate TTM. EEG monitoring may be considered during TTM. Assessment of neurologic prognosis should not occur less than 72 hours after ROSC unless there is otherwise objective evidence of irreversible injury (such as Brain Death), or other extenuating circumstances as determined by care team (see **Policy 315** for Brain Death determination guidelines). Prognostication must be delayed if there are ongoing confounding factors such as sedation or ongoing hypothermia that may influence the exam. Serial NSE (checked at 24, 48, and 72 hours post ROSC) may be helpful with prognostication. Imaging with CT or MRI may be recommended, and EEG may be repeated during multimodal prognostic evaluation. Other diagnostics may be recommended by the Neurology consult service.

IV. GOALS OF CARE

For patients with existing POLST/Goals of Care documentation prior to arrest, these will be followed. Updated goals of care discussions will occur at the discretion of the Attending Physician once prognostication of overall clinical status is able to be determined or once neurological prognosis is possible. Certain clinical scenarios also may necessitate goals of care discussion earlier than 72 hours post ROSC on a case-by-case basis.

V. PROVISION OF TARGETED TEMPERATURE MANAGEMENT: Other indications in adults

At the discretion of the provider, TTM may be used for patients who need temperature control in a variety of conditions including, but not limited to, traumatic brain injury, refractory intracranial hypertension, ischemic or hemorrhagic stroke, meningitis, and refractory fever. Provider will determine temperature goal and duration based on the indication.

A. Initiation

1. Place closed loop cooling device on patient
2. Place core temperature device (foley or esophageal preferred, rectal as alternative) and connect to cooling device input
3. Provider to select temperature goal depending on indication (See **Appendix A**) and initiate TTM order set
4. Set closed loop cooling device to goal temperature as selected in orders
5. Notify provider if patient not able to achieve goal temperature within 4 hours

B. Maintenance

1. Monitor for shivering utilizing BSAS and treat per orders
2. Continue temperature monitoring using a core temperature probe.
3. Nursing staff shall record temperature and vital signs, as per provider orders.
4. Monitor labs and replete electrolytes to goal per orders.
5. Provider to determine duration of maintenance phase based on indication.

C. Rewarming
1. Avoid rewarming rate >0.25°C per hour
2. Continue to avoid fever after discontinuation of TTM

VI. STAFF EDUCATION AND TRAINING

Attending physicians, house-staff physicians under the supervision of faculty attending physicians, and Nursing staff (Emergency Department, Critical Care, Cardiac Catheterization Laboratory) will take part in the provision of TTM. In-service and training in the use of specialty cooling devices shall take place. A TTM committee made up of involved representatives from Medicine, Neurology, Emergency Medicine, Pediatrics and Nursing shall be available for ongoing assessments.

VII. DATA COLLECTION

In addition to being part of guideline-based and evidence-based care, provision of TTM is part of the Los Angeles County Emergency Medical Services (EMS) program for management of Out-of-Hospital Cardiac Arrest (OHCA). Data collection and tracking for OHCA shall occur as per the EMS ST-Elevation Myocardial Infarction Receiving Center (SRC) and Cardiac Arrest Programs and shall be performed through the current mechanism of the SRC at Harbor--UCLA Medical Center. Data fields are determined and agreed upon per the SRC Advisory Committee. All OHCA post-ROSC patient data will be entered into the SRC database. Special attention is required in attaining a Glasgow Coma Score (GCS) and Cerebral Performance Category (CPC) scale rating on all patients upon hospital discharge to determine outcome on the post-ROSC patient.

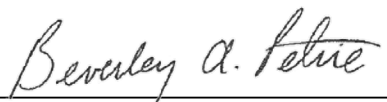
VIII. QUALITY ASSURANCE/QUALITY IMPROVEMENT

Data on the provision of TTM at Harbor-UCLA (inclusive of the number of patients eligible, number of patients treated, times to target temperature, survival, and neurologic outcomes of treated patients) will be reviewed within the local SRC program committee meetings as part of an ongoing system review and QA/QI process. A QI review will be performed on all deaths or fallouts per the SRC standards or QI fallouts identified within the EMS agency database, and per Harbor-UCLA TTM policy. Fallouts will be identified with the dates of review in the pertinent committees and a corrective action applied, if applicable, from each committee. Meetings will occur at least on a quarterly basis including members of Nursing staff and physicians from the Departments of Medicine and Emergency Medicine.

IX. PEDIATRIC CONSIDERATIONS

Per LA county SRC, TTM may be considered for any patient over age 14 with ROSC post-CA. Evidence for management in the pediatric population remains limited. Pediatric management and treatment goals are per attending preference as listed in **Appendix A**. See separate policy for neonatal therapeutic hypothermia management.

Reviewed and approved by:
Medical Executive Committee 06/2023



Beverley A. Petrie, M.D.
President, Professional Staff Association

APPENDIX A: SUMMARY OF CARE BY DIAGNOSIS

	Post TFA	TBI	Pediatric TBI/Post Cardiac Arrest	Adult Cardiac Arrest (any rhythm)	Refractory fever
Temperature range tolerated	35°C - 37°C	35°C – 37.5°C	36°C – 37.5°C	32°C – 37.5°C	36-37.5°C
Recommended default goal temp	36°	35°	37.5°	35°	37.5°
Duration	TTM 24 hours, then avoid fever for 48 hours	AP, as needed for ICP and/or fever control	AP	TTM 24 hours, then continue cooling device for 48 hours (normothermia goal)	AP
Goal MAP	AP	AP (or CPP goal)	AP	MAP >70	AP
Glycemic Control ICU	100-200 mg/dl	100-180 mg/dl	AP	100-200 mg/dl	100-200 mg/dl
GOC conversation <72 hours	Approved by attending OR initiated by family	Approved by attending OR initiated by family	Approved by attending OR initiated by family	Approved by attending OR initiated by family	Approved by attending OR initiated by family
Prognostication	AP	AP	AP	After 72 hours of normothermia	AP
Timing of WLST (Assumes no extenuating circumstances)	72 hours after normothermia OR family request	72 hours after normothermia OR family request	AP	72 hours after normothermia OR family request	AP
Hypothermia Device	Closed loop surface cooling	Closed loop surface cooling	AP	Closed loop surface cooling	AP
Rewarming	≤0.25 °C per hour until goal	≤0.25 °C per hour until goal	Passive or AP	≤0.25 °C per hour until goal	AP

AP - Attending Preference
CPP - Cerebral Perfusion Pressure
MAP - Mean Arterial Pressure
TBI – Traumatic Brain Injury
TFA – Traumatic Full Arrest
TTM - Targeted Temperature Management
WLST - Withdrawal of Life Sustaining Treatment

APPENDIX B: SUGGESTED SHIVERING MANAGEMENT PROTOCOL

Tier 1

- Skin counter-warming: Wrap hands and feet in warm towels and warm packs in hands or use other external warming device. Cooling is most efficient using the core, warming of extremities should not affect ability to cool patient.
- Acetaminophen 650 mg q 4-6 hrs PO or IV (do not exceed 4 gm per 24 hrs.)
- Buspirone 30 mg q 8 hr PO

Tier 2 – If BSAS is ≥ 1 after 60 minutes in Tier 1 (and continue above orders from Tier 1)

- Magnesium sulfate IV continuous infusion, goal serum Mg 3.0-4.0 mg/dL (avoid if serum Cr > 2.0 or CrCl < 30 mL/min). Check serum levels q 4 hr while on infusion.
- Meperidine 12.5 mg or 25 mg IV q 4 hr. prn. May repeat x1 dose (12.5 or 25 mg) 5 minutes after first dose. (DO NOT use if patient has CrCl < 30 ml/min, or history of seizures)

Tier 3 – If BSAS is ≥ 1 after 60 minutes in Tier 2 (and continue above orders from Tiers 1 and 2)

- Dexmedetomidine IV continuous infusion – initiate at 0.2 mcg/kg/hr. Titrate per protocol to maximum of 1.2 mcg/kg/hr to achieve BSAS goal.

Tier 4 – If BSAS is ≥ 1 after 60 minutes in Tier 3 (and continue above orders from Tiers 1-3)

- Fentanyl IV continuous infusion per protocol
- Propofol IV continuous infusion per protocol to maximum of 80 mcg/kg/min
    - If on Propofol gtt: check baseline and daily ABG, CK, lactate, creatinine, CK, triglycerides levels

Tier 5 – If all above therapies have failed. Patient must be on continuous sedative and pain medication infusions with a stable RASS of ≤ - 4 prior to neuromuscular blockade.

- Select one of the below neuromuscular blockers:
    - Vecuronium (preferred) 0.05 mg/kg every 2 hr IV prn for BSAS ≥ 1
    - Cisatracurium (if contraindications to vecuronium) 0.02 mg/kg IV every 15 min prn for BSAS ≥ 1

Bedside Shivering Assessment Scale (BSAS):
0 – None: No Shivering
1 – Mild: Shivering localized to neck/thorax, may be seen only as artifact on ECG or felt by palpation
2 – Moderate: Intermittent involvement of the upper extremities in addition to neck/thorax
3 – Severe: Generalized shivering or sustained upper/lower extremity shivering

Reference:
Choi, H.A., Ko, SB., Presciutti, M. et al. Prevention of Shivering During Therapeutic Temperature Modulation: The Columbia Anti-Shivering Protocol. Neurocrit Care 14, 389–394 (2011).

APPENDIX C: Adult Post Cardiac Arrest TTM Algorithm