ICR-TTM-031

Critical care · post–cardiac arrest

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CRITICAL CARE ORDER SET

Therapeutic Temperature Management

Post–ROSC neuroprotection for the comatose survivor of cardiac arrest. Pick a target and hold it, suppress shivering aggressively, protect MAP and oxygenation, then rewarm slowly and prevent fever to 72 h. Defer all neurologic prognostication. Adapt every target to your institutional protocol and the individual patient.

PATIENT	MRN	ARREST → ROSC TIME	INITIAL RHYTHM
TARGET TEMP	**TARGET REACHED (TIME)**	**ORDERING CLINICIAN**	**ATTENDING**

01 Indications & temperature target

INDICATION Adult post–ROSC who is **comatose (not following commands)** after out-of-hospital or in-hospital cardiac arrest.

CONTRAINDICATIONS / RELATIVE — SCREEN & DOCUMENT

- ☐ Active major bleeding; severe coagulopathy
- ☐ Uncontrolled shock / hemodynamic instability despite vasopressors
- ☐ Refractory arrhythmias
- ☐ Intracranial hemorrhage
- ☐ Severe sepsis; recent major surgery
- ☐ Pregnancy; DNR/DNI limiting intensive support

INITIATE TTM — SELECT TARGET PER INSTITUTIONAL PROTOCOL

33 °C	35 °C	36 °C
Deeper hypothermia	Intermediate	Controlled normothermia

- [ ] Maintain at target **24 h** (or per protocol); controlled rewarming **0.25–0.5 °C/h** to 36–37 °C; then **prevent fever for 72 h from ROSC**

CORE TEMPERATURE MONITORING

- [ ] Core probe — **esophageal**, **bladder**, or **intravascular catheter** sensor (if cooling catheter used)
- [ ] Document core temp **q15–30 min** until stable at target, then **q1 h**

02 Cooling modality & nursing orders

COOLING METHOD — PICK BY RESOURCES

Surface cooling

- [ ] Computer-controlled device (gel pads / cooling blanket) set to target
- [ ] Connect core probe as the control-input sensor

Intravascular catheter · if available

- [ ] Insert femoral / subclavian catheter sterilely; connect console, set target + alarms
- [ ] Daily line care + CLABSI prevention bundle

INDUCTION ADJUNCTS

- [ ] Cold IV crystalloid **500–1000 mL 0.9% NaCl / LR at 4 °C** if MAP tolerates, to speed induction; remove excess clothing / blankets
- [ ] **Avoid overcooling < 32 °C** — set device lower-limit alarms

NURSING / BEDSIDE

- [ ] Neuro checks + RASS **q1 h**
- [ ] Continuous telemetry, invasive arterial pressure, capnography if intubated
- [ ] Reposition **q2 h**; pressure-injury prevention bundle
- [ ] Vitals (HR, BP, RR, SpO_2, core temp) **q15 min** during induction → **q1 h**
- [ ] Strict I/O; Foley with temperature probe
- [ ] Mouth care **q4 h**; VAP prevention bundle if intubated

03 Airway, breathing, circulation

AIRWAY / VENTILATION

- [ ] Maintain ETT, secure and confirm placement; ventilator mode per ARDSNet / local ICU standard
- [ ] Target SpO_2 94–98%
- [ ] Target $PaCO_2$ 35–45 mmHg
- [ ] ABG on ICU arrival, then q4–6 h and PRN clinical change (temperature-correct interpretation per protocol)

HEMODYNAMIC GOALS

- [ ] Target MAP ≥ 65 mmHg (individualize, e.g., 70–75 in chronic HTN); **avoid hypotension** (SBP < 90 or MAP < 65)
- [ ] Continuous arterial line; titrate **norepinephrine** to MAP goal
- [ ] IV fluids — maintenance balanced crystalloid / D5½NS at __ mL/h; bolus 250–500 mL isotonic PRN if not overloaded
- [ ] Consider inotropes (echo-guided) if low cardiac output state suspected

04 Sedation, analgesia & shivering control

GOAL Suppress awareness and shivering, allow ventilator synchrony — **RASS −4 to −5 during cooling**. Shivering generates heat and defeats TTM; treat it up a stepwise ladder.

SEDATION & ANALGESIA

- [ ] **Propofol** 5–80 mcg/kg/min IV to RASS goal (hold / adjust for hypotension or hypertriglyceridemia) — **OR midazolam** 0.02–0.1 mg/kg/h IV
- [ ] **Fentanyl** infusion 25–200 mcg/h IV; breakthrough 25–50 mcg IV q15 min PRN

SHIVERING LADDER

BASELINE	Surface counterwarming — warm blankets to hands / feet / head; adjust set point slowly
FIRST-LINE	Acetaminophen 650–1000 mg PO/NG/PR q6h (max 4 g/day) · magnesium to Mg^{2+} ≥ 2.0–2.5 (consider 2 g IV load then infusion) · buspirone 30 mg PO/NG q8h

SECOND-LINE Meperidine **12.5–25 mg IV q2–4h PRN** (cap cumulative dose; renal function permitting) · dexmedetomidine **0.2–1.4 mcg/kg/h IV**

THIRD-LINE **Refractory only** — neuromuscular blockade with adequate sedation (continuous EEG strongly preferred): cisatracurium **1–3 mcg/kg/min IV** or boluses; TOF monitoring, document

05 Neurologic monitoring & prognostication

- [ ] Baseline neuro exam documented on ICU arrival

CONTINUOUS EEG — INITIATE IF

- [ ] Myoclonus, suspected seizures, or unexplained hemodynamic / respiratory changes
- [ ] Deep sedation or paralysis where clinical seizures cannot be assessed

DEFER Maintain TTM ≥ 24 h before any formal prognostication. **Order:** "No withdrawal of life-sustaining therapy based solely on neurologic status until ≥ 72 h after normothermia and multimodal prognostic evaluation, unless a clear non-neurologic indication (refractory shock, etc.) exists."

06 Laboratory & glucose monitoring

BASELINE (ON ARRIVAL)

- [ ] CBC, CMP (incl. LFTs), Mg, Phos, Ca
- [ ] ABG / VBG with lactate
- [ ] Blood cultures / procalcitonin if infection suspected
- [ ] Coagulation (PT/INR, aPTT)
- [ ] Troponin (serial if ACS suspected); CK, CK-MB if indicated

ONGOING

- [ ] BMP, Mg, Phos, Ca **q6–12 h** for first 24–48 h then daily (more if unstable); ABG **q4–6 h** PRN
- [ ] POC glucose **q1–2 h** initially → **q4 h** if stable; insulin to **140–180 mg/dL** (avoid hypo- and marked hyperglycemia)

- [ ] Drug levels if indicated (e.g., antiepileptics)

07 Electrolyte & metabolic management

POTASSIUM	MAGNESIUM	PHOSPHATE
3.5–4.5	≥ 2.0	≥ 2.5
mEq/L · often ≥ 4.0	mg/dL	mg/dL

REWARMING Anticipate shifts during cooling and **especially rewarming** — cooling drives K^+ intracellularly (don't over-replete) and rewarming releases it. Check electrolytes more frequently (**q4 h**) during rewarming.

- [ ] Treat metabolic acidosis / alkalosis based on ABG and clinical status

08 Cardiac evaluation & ACS management

- [ ] **12-lead ECG on arrival**; repeat with any clinical change
- [ ] Cardiology consult — **emergent coronary angiography** if STEMI or high suspicion of acute coronary occlusion
- [ ] Standard ACS orders if indicated — aspirin, P2Y12 inhibitor, anticoagulation per cardiology
- [ ] Echocardiogram within **24 h** to assess LV/RV function and valve disease

09 Infection prevention & general ICU care

- [ ] **VAP bundle** — HOB 30–45°, daily sedation assessment, oral chlorhexidine, closed suction, subglottic-suction ETT if available
- [ ] Central-line bundle and Foley care per ICU standards
- [ ] **DVT prophylaxis** — SCDs (mechanical); pharmacologic enoxaparin **`40 mg SC daily`** or heparin **`5,000 units SC q8–12h`** unless contraindicated
- [ ] **GI prophylaxis** — PPI or H2 blocker if intubated / bleeding risk, unless contraindicated

- [ ] Early enteral nutrition within **24–48 h** if hemodynamically stable (trophic feeds during cooling per protocol)

10 Rewarming phase (after 24 h at target)

CONTROLLED REWARMING

- [ ] Increase set point **0.25–0.5 °C/h** up to 36–37 °C; **avoid overshoot > 37.5–38 °C**; core temp **q30–60 min**

ADJUST SEDATION / SHIVERING & ELECTROLYTES

- [ ] Continue shivering prophylaxis through rewarming; gradually lighten sedation once normothermic and hemodynamically stable to reassess neuro status (unless contraindicated)
- [ ] Increase electrolyte monitoring to **q4 h** and replete as needed (watch rebound hyperkalemia)

> **THEN** After rewarming, **actively prevent fever through 72 h from ROSC** — keep the device in place and maintain normothermia.

11 Documentation & family communication

DOCUMENT

- [ ] Indication, target temp, start time, modality
- [ ] Major complications (arrhythmia, bleeding, infection, instability)
- [ ] Neuro status at baseline and key time points
- [ ] Code status & goals-of-care discussion

FAMILY / GUARDIAN COMMUNICATION

- [ ] Explain TTM goals, duration, the **delayed nature of neurologic prognostication**, and the range of possible outcomes

EDUCATIONAL USE ONLY

Not a substitute for clinical judgement. Verify doses, allergies, renal/hepatic function, and contraindications. Adapt the temperature target, duration, and all agents to your institutional post–cardiac-arrest protocol and the individual patient.

Spreading knowledge
Improving outcomes