

Atrium Health

ADULT Post-Cardiac Arrest Resuscitation Care

Emergency Department / Inpatient

Clinical Practice Guideline

EXECUTIVE SUMMARY

This guideline outlines optimal post-cardiac arrest resuscitative care that includes active temperature, hemodynamic, and ventilator management to improve survival and neurologic outcome in patients resuscitated from cardiac arrest. It is based on the 2020 AHA Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care and the most recent evidence as of this clinical practice guideline release.

Key Revisions (2021 Periodic Review):

1. Target temperature changed to 37C with measures to ensure fever avoidance.
2. Modified relative contraindications to include patients with low likelihood of recovery due to underlying disease process that led to cardiac arrest.
3. Relative contraindications have been modified to align with 37°C target temperature. Most notably, unwitnessed asystolic arrests have been added as a relative contraindication to enrollment in this pathway given the very poor prognosis.

Scope:

Disease/Condition(s): Out-of-hospital cardiac arrest (OHCA) and in-hospital cardiac arrest (IHCA)

Clinical Specialty: Emergency Medicine, Cardiology, Critical Care, Neurology

Intended Users: Physicians, Advanced practice providers, Nurses, Pharmacists

Major Outcomes Considered: Sudden cardiac death, survival, morbidity, neurological recovery

Authors: Code Cool Collaborative Team; Contact for Changes: Leslie London or Dr. David Pearson, Emergency Services

Release Date: September 2021 | **Next Review Date:** September 2024

RECOMMENDATIONS

Inclusion Criteria:

- (1) Adults (age \geq 18 years)
- (2) Comatose (GCS < 9 or no motor response to loud stimuli)
- (3) Intubated
- (4) ROSC following resuscitation from cardiac arrest regardless of initial rhythm

Exclusion Criteria:

Absolute Contraindication:

- (1) Severe terminal illness preceding the cardiac arrest
- (2) Do Not Resuscitate (DNR) Status
- (3) Advanced directives indicating no intervention for life support.

Relative Contraindications:

- (1) Resuscitation time (time of collapse to ROSC) > 60 minutes for initial rhythm of VF/VT.
- (2) Resuscitation time (time of collapse to ROSC) > 40 minutes for initial rhythm of PEA or witnessed asystole.
- (3) Unwitnessed asystole regardless of resuscitation time
- (4) Encephalopathy unrelated to cerebral anoxia: This protocol was developed for patients suffering cerebral anoxia due to cardiac arrest. Other causes of coma including overdose/intoxication, stroke, and trauma should be considered prior to implementation of cooling.
- (5) Traumatic arrest due to exsanguination: Patients involved in a traumatic event (i.e., motor vehicle crash) with the participating event of cardiac arrest without evidence of significant traumatic injury should be considered for Code Cool.
- (6) Imminent cardiovascular collapse despite aggressive resuscitative measures.
- (7) History of moderate to severe dementia.
- (8) If recovery from the underlying disease process that led to the cardiac arrest is unlikely, do not proceed with aggressive resuscitative measures via this guideline.

*** The inclusion and exclusion criteria are provided as a guideline and clinical discretion supersedes these criteria if the benefit outweighs the risk. ***

Activation and Logistics:

- (1) Upon meeting inclusion/exclusion criteria, Activate ADULT CODE COOL via the Atrium Health-Physician Connection Line (PCL) at 704-512-7878 or other connection line that ensures patient tracking). This is imperative for patient tracking and should be done at both Level I (Receiving) and Level II (Transferring) Cardiac Resuscitation Centers for both out-of-hospital and in-hospital cardiac arrests. If questions arise regarding the candidacy of the patient for the ADULT CODE COOL pathway, discussion with the Emergency Medicine and Pulmonary Critical Care (PCC) Medicine attending at the Level I Center should be done.
- (2) Comatose cardiac arrest patients with ST-elevation myocardial infarction (STEMI) are candidates for emergency percutaneous coronary intervention (PCI). Activation of Code STEMI should be done per clinical pathway shown in Appendix 1.
- (3) Once the patient is at the Level I Cardiac Resuscitation Center, Pulmonary Critical Care Consultants (PCCC) and Cardiology consultant teams should be consulted for shockable initial rhythm; if PEA/asystole, PCCC should be consulted and will notify Cardiology teams as needed.

Temperature Management with Target 37°C Guidance:

1. **ED/non-ICU Management:** During ED evaluation, ensure temperature does not go above 37.8°C. If temperature exceeds 37.8°C, administer antipyretic medications to decrease temperature. If at a facility without an active controlling device (Arctic Sun or Zoll), then utilize ice packs and cold IV fluids to decrease temperature, in combination with a paralytic bolus to decrease temperature with the primary goal to prevent fever.

2. **ICU Management:**
 - a. Upon arrival to the ICU, actively control patient temperature with a device (Arctic Sun or Zoll) with temperature set at 37°C with intended duration for **72 hours** after sustained return of spontaneous circulation. Keep pads in place if patient remains comatose and still requiring active temperature management.
 - b. Water temperature for the Arctic Sun device < 20°C is indicative of an underlying fever and should prompt antipyretics and search for a potential source of infection.
 - c. If patient remains comatose after 72 hours, please keep the temperature management device (with Arctic Sun pads) in place to ensure active control for an additional 24 hours.
3. **Duration of Active Temperature Management:** 72 hours from ROSC.

Sedation/Shivering Guidelines:

1. Initiate sedation with **fentanyl** and **propofol** per FirstNet PowerPlan (Code Cool Maintenance) and titrate to resolution of clinical shivering and temperature control. Midazolam may be substituted for propofol if needed. See CRIT Sedation and Analgesia for the Mechanically Ventilated Patient.
2. The desired level of sedation is Richmond Agitation Sedation Scale (RASS) +1 to -1.
3. First line therapy to optimize sedation is to optimize dosing of fentanyl and propofol. Second line therapy is with midazolam per FirstNet PowerPlan (Code Cool Maintenance, Rewarming, and Normothermia).
4. Sedation should be maintained for a minimum of 40 hours from ROSC time if findings suggestive of fever (i.e., Arctic Sun water temperature < 20°C). If no evidence of fever, intermittently holding sedation to assess neurological status is reasonable after 12 hours. If awake and following commands, then consider moving toward extubation. If remains comatose, then restart sedation for desynchrony, fever, or shivering control.
5. The desired level of shivering control is a Bedside Shivering Assessment Scale (BSAS) ≤ 1.
 - a. If BSAS GREATER than 1, continue titration of propofol and fentanyl to RASS -4 or maximal doses, then
 - b. If BSAS still GREATER than 1 after 15 minutes, add socks and gloves (can use socks on hands as well), then
 - c. If still BSAS still GREATER THAN 1 after 15 minutes, administer Magnesium Sulfate per Code Cool FirstNet PowerPlan. Notify Provider if Magnesium is GREATER THAN 3 mg/dL,
 - d. If still BSAS still GREATER THAN 1 after 30 minutes from starting Magnesium Sulfate infusion, add vecuronium 0.1 mg/kg IV Q1 hour PRN.

Table 1. Bedside Shivering Assessment Scale¹⁴

Score	Type of Shivering	Location
0	None	No shivering is detected on palpation of the masseter, neck, or chest muscles
1	Mild	Shivering localized to the neck and thorax only
2	Moderate	Shivering involves gross movement of the upper extremities (in addition to neck and thorax)
3	Severe	Shivering involves gross movements of the trunk and upper and lower extremities

Hemodynamic Recommendations:

- (1) Target mean arterial pressure (MAP) > 70 mmHg. May need MAP > 80 mmHg for improved Cerebral Perfusion, especially in patients with chronic hypertension. Post-arrest hypertension (MAP > 120 mmHg) may occur and may improve cerebral perfusion. Hypertension in this range should not be lowered in the absence of end-organ dysfunction.
- (2) Post-cardiac arrest patients frequently require vasopressors. Anticipate post-cardiac arrest shock, as 50% of post-arrest patients will develop hypotension.

- (3) Norepinephrine is the preferred initial vasopressor. If needed, begin **Norepinephrine** (Levophed) at 7 mcg/min and titrate by 1 to 2 mcg/min every 2 minutes to maintain MAP 70 to 80 mmHg. Notify provider if infusion rate is > 30 mcg/min.
- (4) Routine central venous catheters (CVC) are not mandatory unless patient requires vasopressor support. Refrigerated IVF should be preferentially administered via a peripheral intravenous line. If a central venous catheter is clinically indicated, STERILE technique is essential. Avoid CVC placement in the LEFT subclavian vein to preserve this site for internal defibrillator placement.
- (5) Vasodilators, beta-blockers, and anti-dysrhythmics should be used judiciously.

Ventilator Recommendations:

- (1) Avoid hypoxia and hyperoxia. Aim for normoxia. Target P_AO₂ to approximately 100 mmHg. Titrate F_IO₂ rapidly while ensuring oxygen saturation remains 95% to 97%.
- (2) Avoid hyperventilation. Target P_aCO₂ 40 – 45 mmHg or titrate P_{ET}CO₂ for 35 – 40 mmHg.

Neurology Consultation, EEG Monitoring, and Neurological Prognostication:

- EEG monitoring for Code Cool patients should be considered and when utilized, should be instituted in the ICU. (see “Guideline for EEG Monitoring for Patients Undergoing Post-Cardiac Arrest (Code Cool) Clinical Care Pathway at Atrium Health).
- Consult neurology for assistance with prognostication or seizure control as clinically indicated, but neurology consultation is not required to obtain EEG monitoring.
- Neurological prognostication should be performed per institutional/hospital-specific guidelines.
- Neurological prognostication is challenging in the post-arrest patient that undergoes therapeutic hypothermia and typically should not be attempted until **96 hours after ROSC** with the exceptions of myoclonus status (as defined as generalized myoclonic convulsions in face and extremities and continuous for a minimum of 30 minutes) in the first 24 hours after admission, brain death due to cerebral herniation, or because of ethical reasons (for instance: previously unknown information about disseminated end-stage cancer or refractory shock with end-stage multi-organ failure). However, assumptions of a poor neurological function should be avoided as the sole reason for withdrawal of active treatment prior to 96 hours after ROSC.

Post-Arrest Emergent Cardiac Catheterization Guidance:

- **STEMI:**
 - o Active Code STEMI for OHCA patients with suspected cardiac etiology of arrest, ST-segment elevation on ECG that meet STEMI criteria, and a MIRACLE2 score < 5 points (see **Appendix 1** for post-arrest emergent cardiac catheterization clinical pathway).
 - o For patients with a MIRACLE2 score ≥ 5 points, individualize patient care including consultation with interventional cardiologist.
- **No STEMI:**
 - o For patients with suspected cardiac etiology of arrest and high-risk ECG findings (e.g., LBBB with Sgarbossa concordance, isolated posterior MI, aVR sign, Wellens, De Winter ST/T-wave complexes), case-by-case consideration is warranted and immediate consultation with interventional cardiologist recommended.
 - o For patients with suspected cardiac etiology without ST-segment elevation on ECG, case-by-case consideration is also warranted, however, evidence shows no difference in survival or neurological outcome at 90 days with immediate vs delayed angiography in patients resuscitated from cardiac arrest.

NEW Order Sets: (FirstNet PowerPlans)

Code Cool – Induction

Code Cool – Maintenance

Assistance with Temperature Management Devices:

- (1) For technical issues related to the Arctic Sun cooling device, assistance may be obtained by calling the Medivance U.S. corporate clinical and technical support hotline at 866-840-9776.
- (2) For technical issues related to the Zoll intravascular cooling device, assistance may be obtained by calling the Zoll technical support hotline at (800) 663-3911.

Disclaimer:

Clinical practice guidelines assist clinicians by providing a framework for the evaluation and treatment of patients. This guideline outlines the preferred approach for most patients. It is not intended to replace a clinician's judgement or to establish a protocol for all patients. It is understood that some patient will not fit the clinical condition contemplated by a guideline and that a guideline will rarely establish the only appropriate approach to a problem.

References:

- (1) Dankiewicz J, et al. Hypothermia vs Normothermia after Out-of-Hospital Cardiac Arrest. *NEJM* 2021; 384:24.
- (2) Bernard, SA, et al. Treatment of comatose survivors of out-of-hospital cardiac arrest with induced hypothermia. *NEJM* 2002; 346(8):556-563
- (3) ILCOR advisory statement: Recommendations from advanced life support task force. *Circulation* 2003;108:118-121.
- (4) Bernard SA, et al. Induced hypothermia using large volume, ice-cold intravenous fluid in comatose survivors of out-of-hospital cardiac arrest: a preliminary report. *Resuscitation* 2003;56(1):9-13.
- (5) Polderman, et al., Induction of hypothermia in patients with various types of neurologic injury with use of large volumes of ice-cold intravenous fluid. *Critical Care Med* 2005;33(122):2744-51.
- (6) Kim F, et al. Pilot study of rapid infusion of 2 L of 4 degrees C normal saline for induction of mild hypothermia in hospitalized comatose survivors of out-of-hospital cardiac arrest. *Circulation*. 2005 Aug 2;112(5):715-9.
- (7) Kim F, et al. Pilot randomized clinical trial of prehospital induction of mild hypothermia in out-of-hospital cardiac arrest patients with a rapid infusion of 4 degrees C normal saline. *Circulation*. 2007 Jun 19;114(24):3064-70.
- (8) Heffner AC, Pearson DA, Nussbaum ML, Jones AE. Regionalization of post-cardiac arrest care: implementation of a cardiac resuscitation center. *Am Heart J* 2012; 164(4):493-501.
- (9) Nielsen N, Wetterslev J, Cronberg T, et al. Targeted temperature management at 33C versus 36C after cardiac arrest. *NEJM* 2013 Dec 5;369(23):2197-206. doi: 10.1056/NEJMoa1310519.
- (10) Kim F, Nichol G, Maynard C, et al. Effect of prehospital induction of mild hypothermia on survival and neurological status among adults with cardiac arrest. *JAMA* 2013. doi:10.1001/jama.2013.282173.
- (11) Neumar et al. Post-cardiac arrest syndrome: Epidemiology, pathophysiology, treatment, and prognostication. *Resuscitation* 2008; 79, 350-379.
- (12) Peberdy M, Callaway C, Neumar R, et al. 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science. Part 9: Post-cardiac Arrest Care. *Circulation* 2010. *Circulation*. 2010; 122: S768-S786.
- (13) Wijdicks E, Hijdra G, Young B, et al. Practice Parameter: Prediction of outcome in comatose survivors after cardiopulmonary resuscitation (an evidence-based review): Report of the Quality Standards Subcommittee of the American Academy of Neurology. *Neurology* 2006; 203-210.
- (14) Badjatia N, Strongilis E, Gordon E, et al. Metabolic impact of shivering during therapeutic temperature modulation: Bedside Shivering Assessment Scale. *Stroke*. 2008; 39(12):3232-3247.
- (15) Hypothermia After Cardiac Arrest Study Group. Mild therapeutic hypothermia to improve the neurologic outcome after cardiac arrest. *N Engl J Med*. 2002 Feb 21;346(8):549-56.
- (16) Callaway CW, Donnino MW, Fink EL, et al. Part 8: Post-cardiac Arrest Care: 2015 American Heart Association Guidelines Update for CPR and Emergency Cardiovascular Care. *Circulation*. 2015 Nov 3;132(18 Suppl 2):S465-82.
- (17) Lemkes JS, Janssens GN, et al. Coronary angiography after cardiac arrest without ST-segment elevation. *N Engl J Med* 2019; 380:1397-1407.

Based on initial versions of Carolinas Medical Center Therapeutic Hypothermia After VT/VF Arrest Care Guidelines, 3rd revision 10/2007. Original Authors: Alan Heffner, MD; Alan Jones, MD; David Pearson, MD.

History of Revisions: Revised 4/08; 1/15; 2/19; 8/21

This Version: Atrium Health Code Cool Collaborative Committee Approval: 8/2021

Appendix 1: Post-arrest emergent cardiac catheterization clinical pathway

