

Title: Induced Hypothermia for Comatose Post Cardiac Arrest Patients.

Source: Hypothermia Workgroup

I. Revision History:

Date Originated: 01/2006

Approval: Critical Care Committee

Related Regulations/Laws: N/A

Related Standards: N/A

II. Purpose: To provide guidelines/ensure appropriate care of the patient being cooled post cardiac arrest with a temperature control device.

III. Supportive Information:

Potential Benefits of Induced Hypothermia:

The primary effect of hypothermia is a decrease in tissue metabolism and inhibition of neural control and transmission. Hypothermia allows hypoperfused areas of the brain to survive the cerebral reperfusion period which can take up to 12 hours and is protective against reperfusion injury. There are randomized controlled trials that demonstrate inducing hypothermia post cardiac arrest in unresponsive patients improves neurological outcomes. The American Heart Association endorsed a class 2A recommendation supporting the use of hypothermia post arrest for unresponsive patients.

Potential Risks of Induced Hypothermia:

Rapid cooling initiates shivering thermogenesis, and increased metabolism (VO₂), ventilation (VE), heart rate (HR), cardiac output (CO), and mean arterial pressure (MAP) thus undermining the goal of therapy.

At temperatures **below 30°C** systemic and cerebral perfusion may be reduced because VO₂, HR, MAP, and CO decrease (bradycardia, hypotension), while hematocrit and total peripheral resistance increase. Diuresis may contribute to the lowering of MAP. Additionally, ECG changes, arrhythmias, electrolyte fluctuations (intracellular K⁺ shift), possible hyperglycemia, and prolonged PT/PTT can also occur leading to cardiac instability and coagulopathies.

IV. Definitions:

Eligible patients:

- Post non-traumatic cardiac arrest
- Cardiac arrest for less than 60 minutes from collapse to return of spontaneous circulation (ROSC)
- Unresponsive

Excluded Patients:

- SBP < 90 mm Hg for > 30 minutes after ROSC despite the use of pressors
- Active bleeding
- Comatose or vegetative state before cardiac arrest
- DNR/DNI

V. Equipment List:

- ArticSun 2000 Non-Invasive Cooling System.
- or
- Cooling Blanket

Vla. Pre-Cooling procedure

Responsibility:	Action:
MD	<ol style="list-style-type: none"> 1. Determine patient eligibility (see above definitions) 2. Obtain intensivist consult now, consider neurology and/or cardiology consult in am. 3. Place a pulmonary artery catheter unless contraindicated 4. Place an arterial line for frequent ABGs
RN	<ol style="list-style-type: none"> 1. Place core thermometer (bladder thermistor or rectal temp probe) 2. Obtain core temperature 3. Obtain vital signs including hemodynamic values if available 4. Obtain a post resuscitation EKG 5. Obtain labs as ordered

Documentation for Pre-Cooling Procedure:

Neuro Assessment
 Core Temperature

Vlb. Initial Cooling Procedure – Goal is 32-33° C

Responsibility:	Action:
RN	<ol style="list-style-type: none"> 1. Patients must be endotracheally intubated <ul style="list-style-type: none"> • Do not over ventilate – Keep pCO₂ at 38-40 and attempt to keep peak pressures <30 • Obtain CXR post intubation per orders 2. Sedate and administer analgesics per orders 3. Paralyze per orders 4. Apply cooling device as soon as possible. <ol style="list-style-type: none"> A. Apply ArticSun 2000 Cooling System <ol style="list-style-type: none"> a. Determine appropriate pad size b. Connect/slave core temperature to Artic Sun c. Apply cooling pads d. Begin cooling e. Set for 33° C and push Automotive Mode button – achieve within 2-6 hours post resuscitation f. Continue cooling to 32-33° C. Temperature will fall a bit lower after cessation of active cooling B. If Artic Sun not available or incremental cooling is desirable the following may be applied per order: <ol style="list-style-type: none"> a. Place one cooling blanket under the patient and one over the patient. Place sheet between the cooling blanket and the patient’s skin. Set for degrees 5° C. Decrease the gradient between patient temp and cooling temp as the patient approaches 33 ° C b. Pack axilla and groin areas with ice packs.

RN	<ol style="list-style-type: none"> c. Administer 2 liters iced saline solution over one hour. d. Continue cooling to 33° C. Temperature will fall a bit lower after cessation of active cooling. e. Maintain temperature of 32-32° C using cooling blankets (and ice packs if needed) <ol style="list-style-type: none"> 5. Monitor ST segment for elevation changes and arrhythmias. Obtain a 12-lead EKG if indicated 6. DVT prophylaxis per orders
	<p>Potential effects of initial cooling process:</p> <ul style="list-style-type: none"> • Tachycardia • Slight increase in blood pressure (10mmHg) • Increased CVP • Decreased CO (increased SVR) • Renal: diuresis, electrolyte loss • Heme: decreased PLT count, impaired coagulation , decreased WBC • GI: decreased motility, mild pancreatitis, increased transaminases • Immune: impaired function of neutrophils and macrophages (increased risk for infection) • Neuro: decreased consciousness, lethargy, • Pharm: altered clearance of meds

Vlc. Maintenance Cooling Procedure

Responsibility:	Action:
RN	<ol style="list-style-type: none"> 1. Record vital signs per orders. 2. Maintain target temperature of 32-33° C for twenty-four hours 3. Hemodynamic parameters per PAC as ordered 4. Skin assessment at sites covered by the gel pads (or cooling blanket/ice packs) q 1-2 hours to avoid cold related injuries 5. Cardiac rhythm interpretation per orders. 6. ABGs per order set. Pulse oximetry may be unreliable due to peripheral vasoconstriction. 7. Maintain blood glucose levels per Intensive Insulin Protocol. 8. Labs per orders 9. Notify the medical team for: <ul style="list-style-type: none"> • Abnormal lab results • Inadequate glucose control (>150 x 2 checks) • MAP <60 mm HG • Inability to reach target temperature within 6 hours • Overshooting core temperature (<32° C) • ST elevation or depression • Urine output <30 ml/hour
	<p>Potential effects during maintenance:</p> <ul style="list-style-type: none"> • Mild arrhythmias in some patients • Increased PR interval • Widening of QRS • Increased QT interval • Possible decrease in infarct size

	<ul style="list-style-type: none"> • Net increase in cerebral blood flow • Reduced ICP • Reduced cerebral metabolic rate • Increased risk for developing pneumonia (depressed immune system, intubated and paralyzed)
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VId. Re-warming Procedure – Goal is no faster than 1° C/hour

Responsibility:	Action:
RN	During rewarming the patient will: <ul style="list-style-type: none"> • vasodilate • shift cooler blood from the extremities to core, leading to after-drop and rewarming shock (hypotension due to relative hypovolemia) 1. At the end of maintenance phase <ul style="list-style-type: none"> • volume load CVP = 8-12 or PCWP to 16-18 approximately 6 - 8 hours before re-warming begins • Stop all potassium administration 8 hours prior to re-warming. Notify MD of K < 3.0 2. Begin re-warming process. <ul style="list-style-type: none"> A. If using the Artic Sun, set warming rate to 0.5° C/hour. Warm to normal body temperature no faster than 1° C/hour B. If using cooling blankets/ice packs, remove ice packs. Remove/adjust the cooling blankets to allow for rewarming no faster than 1° C/hour. Closely monitor core temperature. Use cooling blankets/ice packs to slow the process if necessary. C. Maintain the patient’s temperature at 37° C. Use cooling devices as necessary to prevent rebound hyperthermia.
	Potential effects of re-warming <ul style="list-style-type: none"> • Vasodilation • Hypotension as fluids shift from core to periphery • Electrolyte shifts—(K now moves from intracellular to extracellular space - increased <i>serum</i> K) • Arrhythmias • Rebound hyperthermia

VII. Documentation:

Document assessments and interventions in patient’s medical record.

VIII. Reference:

Bernard, S. A., & Buist, M. (2003) Induced hypothermia in critical care medicine: a review. *Critical Care Medicine*, 31(7), 2041.

Bernard, S.A, Gray TW, & Buist, M et al. (2002) Treatment of comatose survivors of out-of-hospital cardiac arrest with induced hypothermia. *NEJM*, 2002;346:557563.

ILCOR Advisory Statement 2003: *“Unconscious adult patients with ROSC after out-of-hospital arrest should be cooled to 32°C to 34°C for 12-24 hours when the initial rhythm was VF”*