

**Hypothermia after Cardiac Arrest**  
**Induction Phase**  
**December 2013**

Initiate Protocol (Document Start Time): Goal is to reach target temperature (32-34°C) within 4 hrs:

Open "Therapeutic Hypothermia after Cardiac Arrest Order Set" in EPIC

**\*Note: The order set contains pre-checked orders designed to be "default" orders specific to the hypothermia protocol only. However, each patient and situation will be different. PLEASE REVIEW the order set in each case to ensure the desired orders are being placed for each individual patient.**

Consult Neurocritical Care Fellow (#513-820-0074 OR NSICU Front Desk: 584-7273):

-Indication: Induction of Hypothermia after Cardiac Arrest

\*Note: Do this for ALL non-traumatic cardiac arrests to discuss implementing the hypothermia protocol. If the decision is made not to induce hypothermia, the specific reason should be clearly documented.

**Induction Phase:**

Onset: Begin within 1 hour of ROSC

Duration: Until target temp (32-34°C) reached (goal < 4 hrs of admission):

**Initiate Cooling Measures:**

-Expose the Patient

-If possible, turn the room thermostat off/down

-For goal target temperature of 33°C:

-Apply ICE PACKS to the neck, axilla, torso, trunk, and groin

-Leave extremities exposed unless surface counter-warming is needed.

-Place cooling fan over patient

-If not already given, administer 30 mL/kg (or 2L) saline at 4°C IV Bolus:

-Pre-cooled saline located in ED refrigerator

-Can also be created by placing 2 L NS or LR in a basin with an ice-water slurry for 30 minutes.

-Should be done through peripheral IV if possible

-Must be done under pressure to avoid rewarming of the fluid

-May place IV tubing in ICE to avoid rewarming during administration

-Do NOT repeat if already performed by EMS or other provider

-Apply Cooling Blankets to Patient:

-May use *Blanketrol* or cooling vest containing ice

-Tylenol 650 mg PR or NG q 6° X 4

-Neurocritical Care Fellow for cooling catheter placement:

-Set Machine to "Pre-Cool" and connect tubing

-Default Cooling Catheter will be "ICY-Catheter" (9.3 Fr, 38 cm, 3 cooling balloons) via femoral approach, preferably under ultrasound guidance UNLESS patient has IVC filter.

-If IVC filter is present, use "Cool-Line" catheter via Internal Jugular or Subclavian Vein.

\*Both must be inserted under sterile conditions, and under supervision of Neurocritical Care fellow or attending

Thermogard Setup:

- While catheter is being placed, plug-in Thermogard and set to *“Protocol”*
- Set Thermogard goal temp 33°C
- Set Thermogard rate to *“Max Power”* and connect to catheter

Raise HOB to 30°

Diet: No supplemental nutrition until rewarming complete

Place patient on *“Bed Rest”*

Initiate Continuous Vital Sign Monitoring:

- Cardiac Monitoring
  - via 3 lead monitor
  - observe for changes in cardiac rhythm
- Pulse Oximetry
  - Goal SaO<sub>2</sub> 95-98%
- Blood Pressure:
  - Initial Noninvasive Monitoring is Acceptable
  - Insert Arterial Line as soon as clinically feasible
  - Maintain MAP 70-110 UNLESS CONTRAINDICATED (ex. in some cases of CHF or ACS):
    - May use Norepinephrine drip to maintain MAP > 70 mmHg
    - May use Nicardipine or Nitroglycerin drip to maintain MAP < 110 mmHg
- Respiration:
  - RT should remove humidifier from the ventilator
  - RT should decrease ventilator circuit temperature
  - RT should perform immediate in-line suction and aggressive pulmonary toilet
  - Obtain ABG with initial labs, and adjust ventilator settings accordingly
    - Titrate FIO<sub>2</sub> and PEEP to maintain SaO<sub>2</sub> 95-98%, and FIO<sub>2</sub> 100-300 mmHg
    - Titrate Respiratory Rate and Tidal Volume to PaCO<sub>2</sub> 35-45
  - \*Note: hypoxia, hyperoxia, hypocapnia, and hypercapnia are all associated with poor neurological outcomes. It is imperative to maintain all PaO<sub>2</sub> and PaCO<sub>2</sub> values within the above range.**
- Temperature:
  - Insert both a Foley AND an Esophageal Temperature Probe if possible
  - Note:
    - Foley temperature probes are contraindicated in anuria (<4 cc/hr)
    - Esophageal probes are contraindicated in suspected esophageal rupture
      - IF a Foley or an esophageal probe is not available or is contraindicated (see above), a Rectal Temperature Probe may be used
  - Do NOT use a tympanic or axillary temperature for monitoring

Draw Initial Labs if not already done:

- CBC with differential, PT/PTT/INR
  - Both to monitor any needed anticoagulation as well as to aid in monitoring for bleeding complications.
- Troponin-I
  - Should be checked on every patient after cardiac arrest. In addition to its role as an indicator of primary ischemic heart disease, troponin may also serve as a potential marker of end organ damage.
- Liver Function Tests, Lipase
  - Elevated liver function tests as well as lipase may aid in diagnosis of the underlying disease as well as serve as a potential marker of end organ damage. Hypothermia may also be associated with increased risk for pancreatitis.
- Arterial Blood Gas
  - It is crucial to maintain PaCO<sub>2</sub> and PaO<sub>2</sub> within the normal range (see below)
- Lactate
  - Serves as a marker of end organ damage (see below).
- Renal Panel, iCal, Magnesium, Phosphorous
  - Electrolyte shifts are common with temperature changes, and should be monitored frequently during the protocol (see below).
- Urinalysis, Urine Culture
  - To monitor for urinary tract infection.
- Urine HCG (if female age < 55)

Obtain Initial ECG if not already done

Obtain Initial Imaging:

- Chest X –Ray
- CT Scan of the Head without Contrast:
  - \*Note: MUST be done prior to admission to ICU. However, if it is not the suspected cause of cardiac arrest, this may be delayed until after cardiac catheterization as not to delay coronary intervention.

Repeat Following Labs every 2 hours during induction:

- Blood Gas:
  - Analyze at pt's ACTUAL body temperature (see below)
  - Maintain PaCO<sub>2</sub> 35-45
  - Maintain PaO<sub>2</sub> 100-300
- Lactate
  - Maintain downtrending Lactate
- Renal Panel:
  - Maintain K > 3.5
- fCal:
  - Maintain in "high-normal" range
- Magnesium:
  - Maintain Magnesium > 2.0
- Phosphorous:
  - Maintain in "high normal" range

Initiate and maintain sedation:

- Regardless of method used, titrate to RASS -4-5
  - Options (may choose one or combination from order set):
    - Fentanyl bolus + infusion
    - Propofol bolus + infusion

- Midazolam bolus + infusion
- Dexmedetomidine bolus + infusion

\*Note: May be used in combination with anti-shivering measures (see below)

\*Note: Do NOT initiate paralysis without proper sedation (RASS -3-4)

\*Note: Sedation may be weaned once pt temp > 36.5 and train of 4 is 4/4.

#### Initiate Shivering Assessment:

- Assess q 15-30 minutes during induction:
- Implement Bedside Shivering Assessment Scale (goal BSAS = 0):
  - 0 = No Shivering
  - 1 = Fine movements of masseters, neck, or thorax only
  - 2 = Gross movements of neck and thorax + Movements of the Extremities
  - P = Paralysis Applied

#### Initiate Anti-Shivering Measures - Choose ONE of the options below:

##### 1.) Use of Anti-Shivering Protocol:

For Shivering Scale  $\geq 1$  on initial assessment:

- Buspirone q 8 hrs X 3 PRN
- Magnesium Sulfate 1 g over 1 hr PRN up to 3 hours
- Surface Counterwarming:
  - Warm blankets applied to exposed distal upper and lower extremities
  - Once cooling catheter placed, Bair Hugger may be applied to entire skin

For Shivering Scale  $\geq 1$  after above interventions:

- Fentanyl Infusion 25 – 100 mcg/hr

For Shivering Scale  $\geq 1$  after above interventions:

- Fentanyl Infusion 25-100 mcg/hr
- PLUS
- Dexmedetomidine Continuous Infusion

For Shivering Scale  $\geq 1$  after above interventions

- Propofol Continuous Infusion to achieve deep sedation
- Dexmedetomidine should be discontinued once deep sedation with propofol is to control shivering is initiated.

For Shivering Scale  $\geq 1$  after above interventions

- Neuromuscular Paralysis (see below)

##### 2.) Neuromuscular Paralysis:

Note: Paralysis should never be used alone to control shivering in an unsedated patient.

- Paralysis should only be initiated once patient appropriately sedated.
- Train of 4 should be monitored every hour while paralyzed.

Choose ONE from below:

- Cisatracurium (preferred choice):
  - If bolus is desired, 0.15 mg/kg IV X 1
  - 1-3 mcg/min continuous infusion

- Vecuronium (note: avoid in renal failure):
  - 8-12 mg IV – may redose PRN
- OR
- continuous infusion 1mcg/kg/min

Initiate Glycemic Control:

- q 1 hr Glucose Checks via arterial or venous catheter:
  - Avoid finger stick method, as peripheral vasoconstriction may lead to inaccuracy
- Maintain Blood Glucose 100 - 180 mg/dl:
  - Hypothermia may induce hyperglycemia
  - Initiate glycemic control per ICU protocol
  - Consider early insulin gtt if initial glucose > 180 mg/dl

Monitor Urine Output:

- Relative goal 0.7-1 cc/kg/hr throughout the protocol may be beneficial

Initiate Anti-Seizure Measures (Neurocritical Care Fellow):

- Neurocritical Care Fellow should initiate Continuous Video EEG Monitoring to monitor for seizure activity as soon as possible. This should continue until rewarming is complete and all paralytics are discontinued (unless seizures are diagnosed).
- If seizures are diagnosed, they should be aggressively treated