

MSSM ED Critical Care Induced Hypothermia Protocol

Pt Name: _____

Place Sticker

MRN: _____

Date: [] Time of Screening: [] : [] Your Name: []

Inclusion Criteria (Must have All)

- Post Cardiac Arrest (Any rhythm as cause of arrest is eligible)
- ROSC < 30 min from EMS/Code Team Arrival
- Time now < 6 hrs from ROSC
- Comatose (Does not follow commands)
- MAP > 65 on no more than one vasopressor (Relative)
Note: inotropes don't count as vasopressors and if pt stabilizes, you may start protocol at that point)

Exclusion Criteria

- Pt has DNR, MOLST, **poor baseline status**, or terminal disease
- Age ≥ 80 y/o (Relative)
- Cryoglobulinemia (Relative)
- Uncontrollable Bleeding or Traumatic etiology for arrest
- Intracranial Bleeding (Relative - Consult Neurosurgery)
- Pregnancy (Relative - Consult OB/Gyn)
- Recent Major Surgery (Relative)
- Severe Sepsis/Septic Shock as cause of Arrest (Relative)

Neurologic Exam

Eye Opening	Verbal	Motor	Brainstem
Spontaneous ----- <input type="checkbox"/> 4	Oriented ----- * <input type="checkbox"/> 5	Obeys ----- * <input type="checkbox"/> 6	Pupils React <input type="checkbox"/> yes <input type="checkbox"/> no
Voice ----- <input type="checkbox"/> 3	Confused ----- * <input type="checkbox"/> 4	Localizes ----- <input type="checkbox"/> 5	Corneal <input type="checkbox"/> yes <input type="checkbox"/> no
Pain ----- <input type="checkbox"/> 2	Inappropriate ----- <input type="checkbox"/> 3	Withdraws ----- <input type="checkbox"/> 4	Spont. Resps <input type="checkbox"/> yes <input type="checkbox"/> no
None ----- <input type="checkbox"/> 1	Sounds ----- <input type="checkbox"/> 2	Decorticate ----- <input type="checkbox"/> 3	Doll's Eyes <input type="checkbox"/> yes <input type="checkbox"/> no
	None ----- <input type="checkbox"/> 1	Decerebrate ----- <input type="checkbox"/> 2	
	Intubated ----- <input type="checkbox"/> 1	None ----- <input type="checkbox"/> 1	

Plantar Reflex: L R

List any Sedatives or Paralytics On-Board at time of Exam: []

If any Starred (*) Item is checked off on the neuro exam, the patient is ineligible for the protocol.

Protocol

- If there is a question regarding eligibility, discuss Case with the ICU Fellow or Attending
- List Initial Arrest Rhythm: [] List Number of Minutes from Start of CPR to ROSC: []
- Send blood for: CMP, LFTs, Superstat I, Lactate, CBC, PT/PTT, CK/MB/Troponin, Lipase, Phosphate
- Completely expose patient and place cooling blankets or gel pads with nothing between blankets/pads & skin.
- Place temp probe in **mid-esophagus** (~4 cm above xiphoid via oral/nasal); if unable to place in esophagus, probe can be placed rectally (5 cm)
- Hook blankets/pads and the temperature probe to the same hypothermia machine.
- Set temperature to 33° C and Set the machine to “**Automatic Mode**”.
- List time Now (Starting Protocol): [] : [] List Initial Patient Temperature: [] ° C
- If initial temperature is < 33° C, allow patient to warm to 33° C.
- Begin shivering & sedation protocols (See page 3). Titrate to RASS Score -3/-4 (Ramsay Score 4/5 in the ICU).
- Infuse refrigerated crystalloid, preferably through large bore, peripheral IV.
Administer at ~100 ml per minute using pressure bag (evacuate air first). Maximum initial infusion is 30 cc/kg; if patient not < 34° C after this amount, wait 15 minutes before giving further 250 cc boluses Q 10 minutes.
- Administer Tylenol 650 mg GT Q 6 hours unless pt has allergy.
- If during induction, pt has any shivering unrelieved by the above meds or is not dropping temperature at the expected rate, Vecuronium 0.1 mg/kg x 1 or Cisatracurium (Nimbex) 0.15 mg/kg x 1 should be used
- Total Cold Crystalloid Infused: [] Time that Pt reaches 34° C: [] : []
- If patient's temperature rises above 34° C, infuse 250 cc boluses of cold crystalloid Q 10 min until <34° C.
- Assess for shivering Q 15 minutes. If any signs of shivering, see the protocol on page 5.
- Maintain temperature 32-34° C for 24 hours (ideal temperature is 33° C).
- If significant bleeding or severe hemodynamic instability, consider rewarming. **See ehced.org for protocol.**
- Time of Rewarming: [] : [] Reason Necessary: []
- Maintain MAP > 80: Multiple Pressors and/or Dobutamine may be used during protocol, if fluid loading ineffective.

Post-ROSC Care Package

Induction of Hypothermia

See First Page

Procedures

- Full sterile neck line with CVP monitoring
- Full sterile femoral arterial line (Axillary if femoral contraindicated/unsuccessful)
- Foley Catheter with hourly urine monitoring
- Orogastric Tube on suction

Ventilation

- Position the head of the bed to at least 30° unless contraindicated
- Place patient on AC Mode
- Set Vt to 8 ml/kg Ideal Body Weight (see last page)
- Set IFR to 60 lpm
- Set Initial rate to 16 bpm
- Set Initial O2 to 50%
- Titrate FiO2/PEEP to achieve ABG Oxygen Saturation 90-94%.
- Often pulse ox will not read well due to peripheral vasoconstriction
- Send an ABG, **DO NOT INDICATE THE PATIENT'S TEMPERATURE ON THE ABG ORDER**
Adjust ventilatory parameters to yield uncorrected PaCO₂ of ~45, pH ~ 7.35, PaO₂ of at least 80 and preferably 100-120 mm Hg

Hemodynamic Goals

- **Ensure Adequate Preload**
Assess by passive leg raise, pulse pressure variation, or echo. CVP may provide some indication of fluid depletion if very low. Use normal saline, lactated ringers, or isolyte boluses. Use room temperature fluid if patient at goal temperature. Replace patient's urine losses 1:1
- **MAP > 65** at all times, MAP > 80 is preferred to augment cerebral perfusion
Preferred initial pressor is norepinephrine, may add vasopressin if necessary
If MAP is < 80 and CVP > 10 perform passive straight leg raise to assess fluid responsiveness.
If MAP > 100, start nitroglycerin infusion after ensuring adequate pain control and sedation.
- **ScvO₂ > 75**
Send blood gas as mixed venous blood uncorrected for temperature.
Goal of 75 rather than 70% is the correction for pt's hypothermia.
If ScvO₂ < 75 and HB < 7 (some would advocate <10 as trigger), transfuse patient
If HB > 7, evaluate echocardiogram and consider inotropes vs. balloon pump/revascularization
- **Lactate**
Hypothermia will raise lactate levels and post-arrest patients will have high lactate. Send a baseline level after the patient achieves goal temperature. From this point on, the lactate should stay the same or drop. If lactate is increasing, the patient is under-resuscitated or seizing

Cardiac Testing

- Get EKG immediately upon arrival; at the start of hypothermia induction; and Q 2 hours for the first 4 hours
- If possible, get a bedside transthoracic echo at the start of induction. In the ED, this should be performed by the emergency physician or cardiology. Look specifically for qualitative LV function, RV function, pericardial effusion/tamponade, & gross valve function

MSSM ED Critical Care

Post-ROSC Care Package

Sedation & Pain Control

- To gain the full benefits of hypothermia, it is imperative that the patient is adequately sedated
- Optimize fentanyl infusion rate first (*Start @25 mcg/hour; titrate as per EHCED drip sheet*)
- Add on propofol (*start @ 5 mcg/kg/min, titrate as per EHCED drip sheet*) midazolam, or dexmedetomidine if necessary
- Titrate to RASS Score -3/-4 (Ramsay Score of 4/5 if in the ICU)

Richmond Agitation Sedation Scale (RASS)

Score	Term	Description	
+4	Combative	Overtly combative, violent, immediate danger to staff	
+3	Very agitated	Pulls or removes tube(s) or catheter(s); aggressive	
+2	Agitated	Frequent non-purposeful movement, fights ventilator	
+1	Restless	Anxious but movements not aggressive vigorous	
0	Alert and calm		
-1	Drowsy	Not fully alert, but has sustained awakening (eye-opening/eye contact) to <i>voice</i> (≥10 seconds)	} Verbal Stimulation
-2	Light sedation	Briefly awakens with eye contact to <i>voice</i> (<10 seconds)	
-3	Moderate sedation	Movement or eye opening to <i>voice</i> (but no eye contact)	
-4	Deep sedation	No response to voice, but movement or eye opening to <i>physical</i> stimulation	} Physical Stimulation
-5	Unarousable	No response to <i>voice or physical</i> stimulation	

Labs & Electrolytes

- Send Superstat I (ABG with Electrolytes) and Lactate Q 1 hour for first 4 hours, then Q 4 hours
- On arrival, send CMP, CBC, Lytes, PT/PTT, Lipase, Cardiac Enzymes, Phosphate. Type and Hold, & Pan-Cultures
- Send CMP (complete metabolic panel) and CBC Q 4 hours
- Send Cardiac Enzymes Q 6 hours
- Keep Magnesium at high-normal at all times with aggressive IV repletion
- Replete Potassium if < 3.4 with IV KCl
- Keep iCal at high normal at all times
- Keep Sodium at least 140 at all times, 150 is preferable
- Keep Glucose < 200 with Insulin Drip (preferred) or Subcutaneous Regular Insulin

DVT Prophylaxis

- If no contraindication, Heparin 5000 units subcutaneous Q 8 hours

Stress Ulcer Prophylaxis

- Nexium 40 mg IVSS x 1

VAP Prophylaxis

- Head of bed to 30°
- Place in-line closed suction and perform aggressive pulmonary toilet

Post-ROSC Care Package

Additional Testing

- Consider Head CT if possible neurologic cause to arrest. Note: even an intracranial bleed is not a contra-indication to continuation of induced hypothermia. Consider letting the patient drift to 34°C and administration of dDAVP.
- If there is a question of brain death, consider a CTA of the brain to assess for flow.
- Consider CTA Chest if there is a strong suspicion of PE as the cause of arrest. Bedside dopplers by EP or sono technician may be a good first step
- EEG if seizures (convulsive or non-convulsive) are suspected

Revascularization for STEMI

- PCI is preferred, consult with CPORT fellow/attending and CCU fellow. Hypothermia does not need to be discontinued for PCI.
- If PCI is not available or will be delayed, thrombolysis should be administered. Thrombolysis can be given during hypothermia. CPR performed prior to ROSC should not preclude reperfusion therapy. Use standard doses of Retevase. Consult with CPORT fellow/attending.

Transport to radiology or ICU

- Disconnect the hypothermia machine and leave the blankets and temperature probe in place.
- If the patient returns to the ED, hook the machine back up.
- If the patient's temperature is >34° C, infuse 250 cc boluses of cold crystalloid Q 10 min until <34° C

Post-ROSC Care Package

Shivering Protocol After Induction

Bedside Shivering Assessment (BSAS) (Neurocrit Care 2007;6:213)

0-None, no shivering. Must not have shivering on EKG or palpation.

1-Mild-localized to neck/thorax. May only be noticed on palpation or EKG.

2-Moderate-intermittent involvement of upper extremities +/- thorax

3-Severe-generalized shivering or sustained upper extremity shivering

•All patients receive:

Acetaminophen 650 mg GT Q 6 hours unless allergic

•If BSAS > 1, add **Fentanyl Drip** (Start @25 mcg/hour; titrate as per EHCED drip sheet)

•If BSAS still > 1, add **Propofol Drip** (Start @ 5 mcg/kg/min; titrate as per EHCED drip sheet)

•If BSAS still > 1, add **Bair Hugger Device** for counterwarming on both of patient's arms

•If BSAS still > 1, administer **MgSO4** 2 grams IVSS, then 0.5-1 gram/hr for target serum Mg 3 mg/dl

•If BSAS still > 1, administer **Dexmedetomidine** 1 µg/kg over 10 minutes followed by an infusion

•If BSAS still > 1, change **goal temperature to 32° C**

•If BSAS still > 1, administer **Ketamine** 0.5 mg/kg IVP, may start drip at same dose per hour

•If BSAS still > 1 after titration of above meds, add **Nimbex** 0.15 mg/kg IV Q 1 hour PRN

Paralysis after induction should only be necessary under extraordinary circumstances!

Modified ARDSNet Vent Protocol



NIH NHLBI ARDS Clinical Network
Mechanical Ventilation Protocol Summary
www.ardsnet.org

OXYGENATION GOAL: Uncorrected PaO₂ 80-120/ SpO₂ 88-95%

Use incremental FiO₂/PEEP combinations below to achieve goal

FiO₂	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7
PEEP	5	5	8	8	10	10	10	12

FiO₂	0.7	0.8	0.9	0.9	0.9	1.0	1.0	1.0
PEEP	14	14	14	16	18	20	22	24

PLATEAU PRESSURE GOAL: 30 cm H₂O

Check Pplat (0.5 second inspiratory pause), SpO₂, Total RR, TV and pH (if available) at least q 4h and after each change in PEEP or TV.

If Pplat > 30 cm H₂O: decrease TV by 1 ml/kg steps (minimum = 4 ml/kg).

If Pplat < 25 cm H₂O: TV < 6 ml/kg, increase TV by 1 ml/kg until Pplat > 25 cm H₂O or TV = 6 ml/kg.

If Pplat < 30 and breath stacking occurs: may increase TV in 1 ml/kg increments (maximum = 8 ml/kg).

PART I: VENTILATOR SETUP AND ADJUSTMENT

- Calculate predicted body weight (PBW)
Males = 50 + 2.3 [height (inches) - 60]
Females = 45.5 + 2.3 [height (inches) - 60]
- Select Assist Control Mode
- Set initial TV to 8 ml/kg PBW
- Reduce TV by 1 ml/kg at intervals ≤ 2 hours until TV = 6ml/kg PBW.
- Set initial rate to approximate baseline VE (not > 35 bpm).
- Adjust TV and RR to achieve pH and plateau pressure goals below.
- Set inspiratory flow rate above patient demand (usually > 80L/min)

This package outlines suggestions for the care of the Post-Arrest patient. It does not set a standard of care and individual patient circumstances should always be taken into account when making treatment decisions.