Therapeutic Hypothermia After Cardiac Arrest Protocol

Check Eligibility for Therapeutic Hypothermia Protocol (ALL boxes must be checked):

- Cardiac Arrest (any initial rhythm, any patient location)
- Return of Spontaneous Circulation within 60 minutes (ROSC)
  - Less than 6 hours since ROSC
- Not following commands or with purposeful movement after ROSC
- Age greater than or equal to 18 years old
- Attending physician or chief of service must be notified and agree with initiation of therapy.
- Core temperature must be \( \geq 34^\circ C \)
- Confirm that none of the exclusion criteria apply:
  - Refractory shock
    - SBP less than 90 mmHg despite fluids & pressers
  - Coma clearly unrelated to arrest
    - Overdose, intoxication, stroke, hypoglycemia, seizure, or new /presumed new asymmetry in neurological clinical exam
  - Significant, severe pre-existing neurological impairment
  - Active severe bleeding or thrombocytopenia
  - DNR status or end-stage terminal illness
## Therapeutic Hypothermia After Cardiac Arrest Protocol

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#### PRE-COOLING ORDERS

1. **Baseline Nursing Assessment (Document prior to cooling):**
   - Oral temperature
   - Neurological exam, documented on flow sheet, including:
     - Glasgow Coma Scale Score
     - Limb movement
     - Pupil diameter and response to light
     - Notify physician if patient no longer fits inclusion criteria on previous page

2. **Draw labs, if not already done**
   - Serum Beta HCG on all women of childbearing age
   - ABG
   - Ionized CA
   - CBC with platelets
   - PT
   - PTT
   - BMP
   - Magnesium
   - Phosphorus
   - Lactate
   - CPK
   - Troponin
   - Cortisol Level
   - Blood Cultures
   - UA
   - Urine culture
   - Urine drug screen

3. **CT Head stat if any suspicion of stroke.** ☐ Yes ☐ No

4. **Insert A-line & CVP (should not hold up cooling patient)**

5. **Admit to SICU if surgical patient and not obvious cardiac etiology.**
TREATMENT, STUDIES, DIET, VITAL SIGNS, AMBULATORY PRIVILEGES, MEDICATIONS AND IV’S

HYPOTHERMIA INDUCTION PHASE ORDERS:

6. Decrease patient temperature to 33°C. Goal: Achieve pt temp of 33°C within 1-4 hours of resuscitation. Use the cooling methods indicated below:

   0.9% Normal Saline IV Bolus
   o Infuse two liters of 0.9% Normal Saline IV (room-temp) or chilled (4 degrees C) over 30 minutes. May acquire chilled NS from Pharmacy
   o Chilled NS to be given by peripheral IV only.
   o Stop infusion and notify service for SaO2 less than 90 despite ventilator adjustments as needed
   o Document volume infusion

   Cooling vest and Leg Wraps
   o Get Arctic Sun (charge nurse to call CVICU)
   o Insert an esophageal probe and/or Foley catheter with sensing probe for temperature measurement.
   o Apply cooling vest directly to patient’s torso, leave spine exposed
     ▪ Small, Medium, or Large
   o Apply cooling leg wraps to patient’s legs
   o Connect temperature monitoring device to temperature monitoring port on cooling device. If urine output less than 4 ml/hr, switch to an esophageal probe as primary instead of foley device, if used.
   o Set in “AUTOMATIC” mode with target of 33 ºC
   o See instruction card on cooling machine for further details. www.medivance.com

7. Document VS every 30 minutes until Temperature equal to 33°C then hourly.
8. Sedation
Sedatives should be given during induction and continued until patient is rewarmed.
(See sedation ordersheet)

9. Additional tools for prevention of shivering:
   - Acetaminophen 650mg PR/PO Q6h prn unless contraindicated (e.g. hepatic dysfunction or recent rectal anastomosis)
   - Magnesium 4gm/100ml sterile water IV x1 at 25 ml/hr
     - followed immediately by magnesium 2gm/50ml sterile water IV x1 at 25 ml/hr (total dose mag 6 gm)
     - *6 hr after target temp, draw magnesium level. If magnesium is <3mg/dl, give magnesium 4 gm/100ml IV x1 at 25 ml/hr.
   - Skin counter-warming to face, palms, and feet. Air warming blanket may be used to upper extremities.
     (For each 4 degree C skin increase, will decrease shivering threshold by 1 degree)
   - Buspirone 15-30 mg Q8h per NGT x 48h
     *CONTRAINDICATIONS:
     - MAO inhibitor within past 2 wks
     - concomitant verapamil or diltiazem
   - Meperidine 25 mg IV Q2 hour prn for shivering. Meperidine (Demerol) 12.5 mg IV Q2 hours prn shivering (if CrCl less than 30 ml/min)
     *Buspirone and meperidine synergistic to prevent shivering*

If shivering develops, begin the following medications:
- Meperidine (Demerol) 25 mg IV Q2 hours prn shivering (if normal renal function)
- Meperidine (Demerol) 12.5 mg IV Q2 hours prn shivering (if CrCl less than 30 ml/min)
- If shivering occurs 30 minutes following the first dose of meperidine (Demerol), then start neuromuscular blockade and notify ICU fellow or attdg. (See Neuromuscular blockade order sheet)

10. Neuro checks every 2 hours
    - Notify service for: De-corticate or de-cerebrate posturing, change in symmetry of pupil exam, seizures

11. Continuous BIS and Train of Four, if patient requires neuromuscular blockade.
12. Consult Cardiology if appears to be cardiac etiology, if not already done. Reason: Cardiac Arrest
13. Frequent skin checks while hypothermic pads in place
**THERAPEUTIC HYPOTHERMIA**  
Bedside Checklist page 5 of 8

<table>
<thead>
<tr>
<th><strong>TREATMENT, STUDIES, DIET, VITAL SIGNS, AMBULATORY PRIVILEGES, MEDICATIONS AND IV’S</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HYPOTHERMIA MAINTENANCE ORDERS (BEGIN WHEN TEMP is 33°C)</strong></td>
</tr>
</tbody>
</table>

14. **Maintain patient temperature at 32-34°C for 24 hours using Arctic Sun**  
   - Document start date and time of when pt temperature first reaches target temperature.  
   - Continue to use continuous foley/esophageal temperature measurement feedback

15. **Document Vital signs every 1 hour once temperature reaches target temperature.**  
   - If patient is bradycardic and hypotensive, call physician and consider Dopamine drip (Pts may become bradycardic during cooling phase)

16. **Labs:**  
   - Order the following tests when target temperature is reached:  
     - Glucose  
     - Potassium
   
   - Draw the following labs: **Q6 hours x 24hr from when target temperature reached.**  
     - CBC with platelets  
     - PT/PTT  
     - BMP  
     - Glucose  
     - Ionized Calcium  
     - Magnesium  
     - Phosphorus  
     - CPK  
     - Troponin  
     - Blood cultures at 12 hour lab draw (same time from above)

   *NOTE: Electrolyte replacement protocol for K+ is suspended while undergoing hypothermia, due to severe intracellular shift of K+. Notify ICU for K+ less than 2.8 or K+ greater than 5.2

17. **Notify physician and consider re-warming if there is:**  
   - Development of significant arrhythmias  
   - Coagulopathy or active bleeding  
   - Cardiovascular Instability
TREATMENT, STUDIES, DIET, VITAL SIGNS, AMBULATORY PRIVILEGES, MEDICATIONS AND IV’S

RE-WARMING PHASE ORDERS:

19. Maintain patient temperature at 33°C for 24 hours using Arctic Sun and then begin to re-warm

20. Set machine to Automatic “Gradual” and reset temperature to 37.0 °C. Target patient rewarming by 1 °C every 4 hrs (equivalent to rate of 0.25 °C/hr) and rewarm slowly

21. Labs:
   *Discontinue all K+ replacements, including in maintenance fluids, at least 1 hour prior to re-warming
   ✓ Notify ICU team for K less than 2.8 or K greater than 5.0 prior to re-warming.
   ✓ Blood glucose every 2 hours while re-warming if receiving insulin therapy.
   ✓ Draw labs as clinically indicated

22. Document vital signs every 30 minutes during the re-warming phase.

23. Maintain normothermia for at least 24 hours after temp reaches 37.0 °C, use anti-pyretics and cooling blanket to actively maintain temperature less than or equal to 37.0 °C. Keep Arctic Sun pads in place at least 12 hours after rewarming has been achieved.

24. Stop neuromuscular blockade infusion, if being utilized, when core temperature reaches 36 °C.

25. 0.9% Normal Saline 500 ml boluses, if SBP less than 90 mmHg, or MAP less than 65 mmHg during rewarming.
1. Physician MUST review and discontinue ALL previously ordered sedation and analgesia orders.

2. Please choose fentanyl and either midazolam or Propofol below

3. Monitor pain/sedation until patient reaches desired level then monitor every 4 hours

4. Sedation Level based on RASS
   - Sedation: RASS -1-3 (not useful if paralyzed)

5. Analgesia
   - Fentanyl
     - Fentanyl 100 mcg IV x1, then infuse drip at 100 mcg/hr, titrate to BIS 40-60. May increase infusion by 25 mcg/hr titrating every 1 hour to a designated RASS sedation score.

6. Sedation
   - Propofol (Diprivan®) used for short-term sedation (less than 72 hours)
     1. BP at baseline & before each dosage increase during titration, then every 10 minutes during the first hour of maintenance infusion, then every 1 hour
     2. Add to today’s labs:
        - Triglycerides
        - Lipase
        (Note: reorder in 72 hours if therapy is continued.)
        - Triglycerides
        - Lipase
   - Propofol 1-5 mg/kg/min, start at 2mg/kg/min (Remember propofol metabolism decreased 30% during hypothermia)
     - Increase propofol every 5 minutes by 5 mcg/kg/min until goal of RASS -2 to -3 without shivering
       *(max dose 80 mcg/kg/min due to risk of infusion syndrome)*
       - Change propofol vial and tubing every 12 hours.

   OR

   Alternatives to propofol:
   - Midazolam* (Versed®) used for short-term sedation (less than 72 hours)
     - Midazolam continuous IV infusion (1 mg/ml) at 2mg/hr, increase infusion by 2mg/hr titrating every 1 hour to a goal of RASS -2 to -3 or BIS 40-60. Midazolam 2 mg IV q5 minutes initially until unresponsive to painful stimulation and for BIS 40-60. Midazolam 2 mg IV bolus q5 min PRN. Maximum dose 10 mg/hr, if dose greater than maximum call physician.
     - Dexmedetomidine 0.3-1.5 mcg/kg/min.

Call MD for MAP less than 80 mmHg.
Adult Critical Care Neuromuscular Blockade Order Sheet- Hypothermia Protocol

Neuromuscular blockade

- Cisatracurium (Nimbex) 0.2 mg/kg bolus. Repeat cisatracurium 0.03 mg/kg in 40 minutes if needed. Infusion at 1-5 mcg/kg/min, titrate to Train of Four 2:4 or to suppress shivering. Particularly appropriate if significant hepatic or renal dysfunction.
  - Remember TOF may be unreliable in select hypothermic patients.

- Alternative: Vecuronium 0.1 mg/kg IV bolus for shivering. Repeat vecuronium 0.1 mg/kg IV bolus in one hour (may be earlier if patient demonstrating evidence of inadequate paralytic effect).

- Continuous BIS and Train of Four, if patient requires neuromuscular blockade.
- Stop neuromuscular blockade infusion, if being utilized, when core temperature reaches 36 °C.