POLICY STATEMENT:
Patients undergoing post-cardiac arrest resuscitation and therapeutic hypothermia (TH) will have nursing care provided according to the following policy. Additional patients may be indicated for this protocol if approved by the unit attending physician.

PERSONNEL:
Registered Nurses (RNs) working in the Emergency Department, Cardiac Catheterization Laboratory, and Critical Care Units (CCU, SICU, MICU) in which the use of TH is approved by the Medical Director. A physician order is required to initiate therapeutic hypothermia post cardiac arrest.

BACKGROUND
Brain temperature during the first 24 hours after resuscitation from cardiac arrest may have a significant effect on survival and neurological recovery. Cooling to 33 ºC (range 32-34ºC) for 24 hours decreases the chance of death and increases the chance of neurological recovery. The goal is to decrease the patient’s body temperature as quickly as possible and to prevent patient shivering. Fever during the first 48 hours post cardiac arrest is associated with a decreased chance of good neurological recovery.

NOTE: For patients intolerant of 33 ºC (e.g. Significant hemodynamic instability, marked Bradycardia, increased bleeding, marked QT prolongation) or for patients that clinicians feel uncomfortable with treating to 33 ºC for other clinical factors, it is acceptable to treat with higher TTM temperature goals, up to 36 ºC. The Penn Center for Resuscitation Science may be contacted to discuss eligibility criteria or any other aspect of post-cardiac arrest patient management: 267-253-9035 OR the designated resuscitation resident on call.

I. PROCEDURE:
A. ELIGIBILITY CRITERIA for cooling to 33 ºC.
   1. Post cardiac arrest, defined as a period of absent pulses requiring chest compressions, regardless of location or presenting rhythm followed by return of spontaneous circulation (ROSC).
   2. Less than 12 hours have elapsed since ROSC.
   3. Patient does not have an order for Do Not Resuscitate (DNR) B or C or Do Not Intubate (DNI).
   4. Patient’s pre-arrest cognitive status is not severely impaired (i.e. Glasgow Coma Score [GCS] =15 or performed ADLs independently).
   5. Patient is comatose at enrollment with a Glasgow Motor Score <6 (does not follow commands) per physician, nurse practitioner or physician assistant assessment prior to administration of sedation.
   6. No other obvious reasons for coma.
   7. No uncontrolled bleeding.
   8. No evidence of uncontrollable dysrhythmias.
   10. No comorbidities associated with minimal chance of meaningful survival independent of neurological status.
C. EFFECTS OF THERAPEUTIC HYPOTHERMIA

1. Hypothermia activates the sympathetic nervous system causing vasoconstriction and shivering. Shivering increases oxygen (O2) consumption by 40-100% and may negate the benefits of induced hypothermia. Thus, shivering must be prevented during hypothermia. Sedatives, opiates, and neuromuscular blocking agents are used to counteract these responses and enhance the effectiveness of active cooling.
   a. NOTE: Initiating paralysis in a patient who is already hypothermic should be avoided because it can result in a precipitous drop in core body temperature.
   b. Elderly patients will cool more quickly than younger or obese patients.

2. Hypothermia shifts the oxyhemoglobin curve to the left, which may result in decreased oxygen delivery. However, the metabolic rate is also lowered, decreasing oxygen consumption/CO2 production. Ventilator settings may need to be adjusted due to decreased CO2 production, using blood gases.

3. Hypothermia initially causes sinus tachycardia; then bradycardia.
   a. Extremely important to keep temperatures >30°C
   b. Temperatures <30 °C: Increased risk for arrhythmias
   c. Temperatures <30 °C: Myocardium is less responsive to defibrillation and medications.
   d. Temperatures <28 °C: Increased risk for ventricular fibrillation

4. Hypothermia decreases cardiac output and increases systemic vascular resistance (SVR).

5. Hypothermia can cause an in-vivo coagulopathy which is not detectable by laboratory testing (because blood is re-warmed during testing)

6. Hypothermia-induced diuresis is to be expected and should be treated aggressively with fluid and electrolyte repletion. Magnesium, phosphorus, and potassium should be monitored closely and maintained in the normal range (they will rebound to a higher value during rewarming).

7. Decreased insulin secretion and decreased insulin sensitivity during cooling leads to hyperglycemia, which should be treated aggressively.

8. Re-warming too rapidly can cause vasodilation, hypotension, and rapid electrolyte shifts.

9. Monitor blood sugar prior to rewarming. Monitor for hypoglycemia during the rewarming phase.

10. Rewarming is begun 24 hours from the time target temperature is reached.

11. Maintain sedation and paralysis until temperature reaches 36 °C to avoid shivering and rapid re-warming.

12. Maintain active normothermia for 48 hours after 37 °C is obtained.

<table>
<thead>
<tr>
<th>POTENTIAL LABORATORY ABNORMALITIES ASSOCIATED WITH HYPOTHERMIA</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased Amylase</td>
<td>No intervention unless persistent after rewarming</td>
</tr>
<tr>
<td>Increased LFTs</td>
<td>No intervention unless persistent after rewarming</td>
</tr>
<tr>
<td>Increased serum glucose</td>
<td>Follow insulin protocol</td>
</tr>
<tr>
<td>Decreased K+, Mg, Phos, Ca</td>
<td>Correct as needed</td>
</tr>
<tr>
<td>Increased Lactate</td>
<td>Optimize oxygen delivery</td>
</tr>
<tr>
<td>Metabolic acidosis</td>
<td>Optimize oxygen delivery</td>
</tr>
<tr>
<td>Thrombocytopenia</td>
<td>Correct if active bleeding</td>
</tr>
<tr>
<td>Leukopenia</td>
<td>No intervention unless persistent after rewarming</td>
</tr>
<tr>
<td>Increased PT/PTT</td>
<td>Correct if active bleeding</td>
</tr>
</tbody>
</table>
D. PATIENT MANAGEMENT

1. Patient / Family Teaching
   a. Explain the purpose of hypothermia and the need for pharmacologic paralysis and sedation.
   b. Explain the function of equipment used (cooling unit, patient wraps, peripheral nerve stimulator, and BIS monitor).
   c. Encourage the family to continue to talk to the patient.
   d. Provide emotional support and answer any questions
   e. Offer pastoral care support to the family and facilitate communication between the family and medical team.

2. Equipment
   a. Two one-liter bags of cold (4 °C) 0.9% saline, stored in participating unit’s medication refrigerators (not in the freezer)
   b. Arterial blood pressure monitoring equipment
   c. Gaymar external cooling system (Gaymar III 7900 Blue-faced units preferred)
      i. One torso wrap
         • small/medium for chest sizes 32-46”
         • large for chest sizes 46-54”
      ii. Two leg wraps
         • Weight of Gaymar wraps when filled:
            a. Large torso: 3.0 lbs.
            b. Small/medium torso: 2.5 lbs.
            c. Each leg: 2.0 lbs.
      iii. Temperature sensing indwelling urinary catheter (plugs into cooling unit)
   d. Neuromuscular blockade equipment
      • Peripheral nerve stimulator (see Appendix D for Train of Four Algorithm in Therapeutic Hypothermia Patients).
      • BIS Monitor and sensor if available
   e. In case of emergency, a fluid warmer can be obtained from the SICU or ED
   f. NOTE: Please document in the Comments section of the vital signs flowsheet:
      Time/date protocol was initiated, target temperature reached, rewarming initiated, normothermia reached. If therapeutic hypothermia is initiated in the ED, please document time/date protocol was initiated and target temperature reached (if applicable) in the RN EMTRAC notes.

3. Preparation for cooling
   a. Verify prescriber’s orders (Hypothermia/Post Cardiac Arrest Order Set)
   b. Ensure arterial and central venous catheters are inserted BEFORE or SIMULTANEOUS with initiation of cooling when possible.
      i. Once the patient is cooled to target temperature, it is more difficult for the medical team to place catheters because of vasoconstriction.
   c. Obtain baseline labs per prescriber’s order.
      i. ABG with ionized Calcium and Magnesium
      ii. CBC, Platelets, PT/PTT/INR
      iii. Chemistry Panel 7
iv. Liver Function Panel
v. Amylase, Lipase
vi. Lactate, CPK, MB, CK, Troponin
vii. ScvO2 (once central line placed)
viii. Urinalysis
ix. Additional labs if indicated (discuss with team)
   • Toxicology screen
   • Beta HCG on all women of childbearing age
   • Cortisol level
   • Cultures (blood, sputum, other)
d. Place temperature sensing indwelling urinary catheter (minimal urine output not required). If bladder monitoring is not an option or temperature reading inaccurate, consider an alternative site (ex. esophageal probe or rectal probe).
e. Place nasogastric or orogastric tube while patient is intubated, paralyzed and sedated
f. Thorough skin assessment prior to applying torso and leg wraps per guidelines in Appendix A
   i. Pre-fill the wraps prior to application when possible
   ii. Check skin, especially under wraps every 2 hours

4. Cooling
   a. Induction: Goal is to reach target temperature range of 32-34 ºC within 4 hours of protocol activation
   b. Maintenance: Goal is to maintain target temperature of 32-34 ºC for 24 hours from the time the target temperature is reached.
   c. Administer medications per prescriber’s orders: Sedation and paralytic medications are begun prior to inducing hypothermia and are continued until patient is re-warmed to 36 ºC. Patients must be intubated while receiving chemical paralysis.
      i. Ensure adequate sedation before initiating chemical paralysis using RASS (goal RASS -4); then use BIS monitor if available for patients who are chemically paralyzed (see Bispectral Index Monitoring Policy)
         • BIS monitor goal is 40-60 during chemical paralysis
         • RASS score goal for sedation is -4 (assessed before chemical paralysis) if BIS not used
      ii. Initiate neuromuscular blockade BEFORE cooling when possible
         • Check Supra-maximal stimulation (SMS) level with peripheral nerve stimulator prior to initiation of neuromuscular blockade whenever possible and document on nursing flowsheet
         • Ensure adequate paralysis by using peripheral nerve stimulator
            a. Goal Train of Four is one or two out of four twitches
            b. Train of Four may not be accurate once patient is cooled to goal temperature
            c. Use the Train of Four Algorithm for Therapeutic Hypothermia Patients (Appendix D) to titrate paralytics.
   d. Infuse intravenous (IV) fluids per physician order:
      i. 2 liters of cold saline (4ºC) infused over 30 minutes to facilitate cooling.
ii. NOTE: Administration of cold saline may be changed based on patient condition as per physician order (i.e. if risk of extra fluid outweighs benefit of faster cooling)

e. Apply crushed ice packs to head, neck, trunk, axilla, groin, and limbs if cooling unit unavailable or if cooling is not proceeding rapidly enough. These should be removed once target temperature is reached

f. Gaymar Cooling Unit:
   i. Keep device plugged in at all times during use
   ii. Make sure wraps are filled before applying to the patient
   iii. Apply circumferential torso wrap and connect to first cooling hose
   iv. Apply circumferential thigh wrap to each leg, connect leg wraps together in series, and then connect free ends to second cooling hose (See Appendix C)
   v. If second hose is not available, torso and leg wraps can be attached in sequence together and free ends of leg tubing can be connected to one hose (ensure continuous circuit)
   vi. Connect temperature sensing indwelling urinary catheter to temperature monitoring cable and plug in to Gaymar cooling unit.
      • Minimum urine output not required with bard Temperature Sensing Foley 400 Series
      • If bladder monitoring is not an option or temperature readings inaccurate, switch to an alternative site (ex. esophageal probe placed by physician, nurse practitioner or physician’s assistant).
      • Protect indwelling urinary catheter and temperature probe from coming in contact with cooling blanket wraps
   vii. Ensure cooling blanket is filled with an adequate amount of sterile or distilled water (green line should show on fluid chamber plunger)
   viii. Ensure cooling blanket in- and out-flow tracts are unobstructed and that fluid is filling wraps when machine is turned on.
   ix. Set unit to RAPID Cooling
      • Gray Faced Gaymar Unit (MTA 6900): Automatic mode with target temperature of 34 °C. Once patient reaches 34 °C, set to GRADUAL mode at 33 °C.
      • Blue Faced Gaymar Unit (MTA 7900): Automatic mode with target temperature of 33 °C
   x. If Target Temperature not reached within 4 hours:
      • Contact house officer
      • Add ice packs to groin and axillae
      • Additional 500 ml boluses of cold (4 °C) NSS may be ordered
   xi. If Target Overshoot (< 32 °C)
      • Contact house officer
      • Cooling device will actively warm patient in AUTOMATIC mode
      • Additional warming measures may be needed if temp <31 (warm IV fluids, blankets, heat lamp) until temp increases to >32 °C

g. Cooling is maintained for 24 hours from the time TARGET TEMPERATURE is reached.
5. Monitoring During Cooling
   a. Goal is to maintain patient’s core temperature between 32ºC and 34 ºC for 24 hours from the
time the target temperature is reached.
   b. Monitor cardiac rhythm and watch for arrhythmias if temperature <32 ºC
   c. Management of Temperature Overshoot (<31 ºC)
      i. Check temperature of wraps to make sure warm water is circulating
      ii. Check water level in Gaymar unit
      iii. Apply Blankets
      iv. Heat packs to hands/feet
      v. Heat lamp (in room)
      vi. Increase heater temp on vent circuit
      vii. Warm IV fluids with fluid warmer
   d. Vital signs at initiation of Therapeutic Hypothermia
      i. Every 15 minutes X4 then
      ii. Every 30 minutes X2 then
      iii. Hourly and prn
   e. Maintain MAP 65-100 mmHg
   f. Obtain laboratory values per prescriber’s orders (see section 8)
   g. Monitor patient for signs of shivering with vital signs checks (may be difficult to assess)
      Patients are more likely to shiver between 34-37 ºC
      Shivering may be occurring if the patient is difficult to cool or if the temperature increases
      unexpectedly (this could also occur with seizures). The use of continuous chemical paralysis
does not fully ensure shivering will not occur as Train of Four monitoring can be unreliable in
the hypothermic patient. Assessment for shivering includes:
      i. Palpate face, neck, chin, and chest muscles for vibration
      ii. Observe for skeletal muscle movement of trunk, upper, and lower extremities
      iii. Observe for piloerection (goose bumps)
      iv. Assess for artifacts on cardiac monitor or EKG, which may indicate muscle tremor
      v. Assess for increased EMG on BIS monitor >55dBAssess for artifact in the BIS
      monitor waveform
      vi. Decrease in SVO2 or ScvO2
      vii. Decrease in Gaymar water/blanket temperature (indicating unit is working harder to
cool patient)
   h. Shivering Management during cooling
      i. Notify medical team
      ii. Nonpharmacologic interventions
         • Attempt to decrease patient temperature by 1 ºC if still in cooling phase (but not
            below 32 ºC)
         • Heat Lamp
         • Heat packs to hands/feet
         • Bair Hugger surface warming
      iii. Pharmacologic Interventions available (discuss with medical team – must have
order)
         • Increase paralytics if patient on paralytic infusion
• Demerol
• Propofol infusion
• Bolus dose paralytics
• Magnesium Infusion
• Other medications as ordered by team

i. Monitor urine output hourly
   i. Hypothermia-induced diuresis is common
   ii. Aggressive IV fluid repletion may be required (patient will experience vasodilation during re-warming)
   iii. Confirm decreased urine output with bladder scanner if acute decrease in urine output is noted.

j. Continuous EEG monitoring during chemical paralysis to evaluate seizure activity (must be ordered by prescriber). Therapeutic hypothermia may be initiated before continuous EEG monitoring is started. **Contact EEG technician as soon as possible once decision to cool patient is made (X8899).**

6. Re-Warming
   a. Begin re-warming 24 hours after target temperature reached
   b. Anticipate reduction in venous return (cardiac output) and BP (with decreased CVP) as cooler blood shifts from core to extremities. Follow CVP, ScvO2, urine output, and exam closely. Aggressive IV fluids may be ended to maintain adequate volume status and perfusion during rewarming
   c. Re-warming too rapidly can cause vasodilation, hypotension, and rapid electrolyte shifts
   d. Prior to re-warming
      i. Consider administering additional volume with Normal Saline to compensate for reductions in BP, ScvO2, and central venous pressure that may occur during rewarming
      ii. Potassium and other electrolytes should be corrected to within normal range but K+ containing fluids should be discontinued prior to re-warming
         • Re-warming shifts K+ to the extracellular compartment
      iii. **Check blood sugar and K+ prior to rewarming (within 2 hours of rewarming start time).**
   e. Re-warm gradually:
      i. Re-warm patient to 37°C and maintain paralysis until patient reaches 36°C
      ii. Blue Faced Gaymar Medi-therm III
         • Set in AUTOMATIC mode, MODERATE with target temperature of 37 °C – this will re-warm patient at 0.33 °C/hr.
         • Do not change from AUTOMATIC to MANUAL mode during re-warming – this will re-set the re-warming algorithm
         • If the patient is re-warming faster than the machine allows, notify MD and consider etiology of more rapid warming (i.e. fever).
         • Discontinue cooling system when patient temperature reaches 36 °C
      iii. Gray-Faced Gaymar Medi-Therm III
         • Set in AUTOMATIC mode, GRADUAL
• Increase target temperature setting by 0.33 °C every 1 hour until patient reaches 36 °C
  • Discontinue cooling system when 36 °C is reached.

f. When Train of Four is 4/4 on peripheral nerve stimulator, discontinue BIS monitor and monitor sedation levels using RASS scale.

g. If patient shivering occurs after neuromuscular blockade has been discontinued, notify physician
   i. Interventions to manage shivering may include surface warming (Bair Hugger), Magnesium, narcotics, Propofol, or clonidine
   ii. Patients are more likely to shiver between 34-37 °C

h. Fever-The development of fever in the 48 hour period following re-warming should be treated aggressively.
   i. Notify MD
   ii. Re-apply cooling blanket as prescribed
   iii. Administer anti-pyretics as prescribed

7. Monitoring during re-warming
   a. Vital signs, including CVP
      i. Every 15 minutes X 4
      ii. Every 30 minutes X2
      iii. Every hour and prn
   b. Labs (see section 8)
      i. Monitor for hyperkalemia as potassium will move back into the intravascular space during rewarming
      ii. Monitor for hypoglycemia as glucose may increase as rewarming corrects decreased insulin production and insulin resistance
   c. Monitor for hypotension secondary to vasodilation from re-warming
   d. Monitor for shivering
   e. Shivering Management during warming
      i. Notify medical team
      ii. Nonpharmacologic interventions (be cautious of interventions that may cause patient to re-warm too quickly)
         • Heat packs to hands/feet
         • Blankets
         • Heat Lamp
         • Bair Hugger surface warming
      iii. Pharmacologic Interventions available (discuss with medical team – must have order)
         • Increase paralytics if patient on paralytic infusion
         • Demerol
         • Propofol infusion
         • Bolus dose paralytics
         • Magnesium Infusion
         • Other medications as ordered by team
8. Labs:
   a. Ongoing labs every 6 hours during cooling and re-warming
      i. ABG
      ii. ScvO2 or SvO2
      iii. Glucose
      iv. Lactate
      v. Chemistry panel 5, chloride, glucose, magnesium, calcium, phosphorus
   b. Potassium should be monitored every 4 hours during re-warming phase.
   c. Repeat CPK/Troponin 6 hours after baseline labs and prn as ordered by prescriber
   d. CBC, PT, PTT, every 12 hours
   e. Additional glucose monitoring as needed if patient is on PUPI protocol.

9. Electrolyte Replacement Guidelines for patients with a creatinine <2.0 mg/dl (must have physician order)
   a. Potassium Chloride
      i. 40 mEq every 6 hours prn K+ < 3.4
      ii. For K+ > 3.5 mmol/L while rewarming – DO NOT REPLETEE
      iii. For K+ 3.0-3.5 mmol/L: 40 mEq over 2 hours
      iv. For K+ 2.5-3.0 mmol/L: 60 mEq over 3 hours
      v. For K+ <2.5 mmol/L: 80 mEq over 4 hours
   b. Magnesium Sulfate
      i. 1 gm IV piggyback every 6 hours prn Magnesium < 1.8 mg/dL

10. Post ReWarming
    a. Maintain normothermia (37 ºC) for 48 hours after re-warming complete
    i. Keep wraps on patient and set Gaymar unit to 37 ºC
    ii. Remove wraps every 2 hours for skin assessment
    iii. Obtain order to administer acetaminophen around the clock for 48 hours after re-warming
        • NOTE: Acetaminophen should not be administered in patients with fulminant hepatic failure. Use caution in patients with chronic liver disease or acute liver injury. Consider decreased dosing in this patient population, not to exceed 2 grams daily.

11. During protocol, notify MD for:
    a. Potassium <3.4 or >5.2
    b. Magnesium < 2.0
    c. Uncontrolled shivering
    d. Heart rate <50 or >110
    e. Glucose <60 or >500
    f. MAP <65 mmHg or > 100 mmHg
    g. Patient not cooled to target temperature within 4 hours
    h. Temp <32ºC
    i. Urine output <30 ml/hr
    j. Hemodynamic instability
    k. Dysrhythmias
    l. Fever after re-warming
12. Neuroprognostication
   a. Prognostication for recovery of neurologic function (or meaningful neurologic function) can be performed by a neurologist, neurosurgeon or intensivist. SSEP may be a useful adjunctive test in the determination of prognosis. The SCM order is: Short-latency somatosensory evoked potential study, in upper limbs)
   b. Hypothermia may delay the clearance of sedatives or neuromuscular-blocking drugs and prolong the time period needed for assessment of neurological recovery, which should be carefully considered when goals of care discussions occur.

13. Documentation
   a. Cooling start time, time target temperature reached, time re-warming started, and time re-warming complete in Comments section of Vital Signs Flowsheet in KBC or EMTRAC RN note.
   b. Vital Signs per protocol and prn
   c. Hemodynamics with vital signs
   d. Baseline and ongoing neurological exam, pain assessment and assessment of sedation level
   e. Administration of medications ordered
      i. Time infusions begun
      ii. Dose administered
      iii. Time infusions discontinued
   f. Patient temperature in ºC
   g. Eye care while receiving chemical paralysis
   h. Skin care and repositioning
   i. Patient tolerance to procedure
   j. Patient/family education
   k. Ongoing assessments

REFERENCES:


SUBJECT: HYPOTHERMIA, THERAPEUTIC POST CARDIAC ARREST GUIDELINES
POLICY: 12-006
SUPERSEDES POLICY: 

REVISIONS/REVIEWS:
All Policies Reviewed Annually

Reviewed by:
PPMC Therapeutic Hypothermia Committee 12/2013
PPMC Evidence-Based Practice Committee 01/2014

Disclaimer: Any printed copy of this policy is only as current as of the date it was printed; it may not reflect subsequent revisions. Refer to the on-line version for most current policy. Use of this document is limited to University of Pennsylvania Health System workforce only. It is not to be copied or distributed outside the institution without administrative permission.
Appendix A

Gaymar’s® Clinical Guidelines for Skin Care During Therapeutic Cooling With the Gaymar® Rap R Rounds™

- Assess and document the skin integrity immediately prior to initiation of therapy and according to your department’s routine skin care protocol.
- If possible, pre-fill the Body Wraps prior to application. If this is not possible, ensure that the Body Wraps are in contact with the skin and that the Velcro closures are fastened to accommodate the Body Wraps when they are filled. Once the Body Wraps are filled, check the security of the closures to ensure that they are not constricting the soft tissue. Readjust closures as necessary.
- Check the patient every two hours to ensure that the patient’s skin is in contact with the Body Wraps and note any change in the skin integrity related to:
  - Excess moisture
  - Color of the epidermis
  - Skin texture
- If the patient’s skin under the Body Wraps(s) shows evidence of change due to excess moisture:
  - Dry the skin surface by gently wicking away moisture
  - Excess moisture may macerate the skin and lead to potential for altered skin integrity.
- If the patient’s skin under the Body Wrap(s) shows evidence of change in color or texture:
  - Be sure the Body Wrap(s) are secured without constriction of soft tissue and readjust accordingly.
  - Before reapplying Body Wraps, apply a skin barrier wipe to the isolated skin surface that shows evidence of change.
- Document the assessment and the steps taken.
- It is recommended that the Body Wraps be placed in direct contact with the skin surface. The use of an intermediate layer at the interface of the patient and the Body Wraps will interfere with the effectiveness of the Body Wraps to cool.
- In conjunction with therapeutic cooling, manually turn and reposition the patient:
  - At a minimum of every two hours
  - Coordinate this position change with observation of skin surface as noted in step c.
  - If the patient is at risk for development of pressure ulcers, use appropriate pressure redistribution surface.
Appendix B

Cooling and Re-Warming Process with Gaymar® Cooling Units

COOLING
1. Set unit to RAPID Cooling
   a. Gray Faced Gaymar Unit (MTA 6900): Automatic mode with target temperature of 34 ºC. Once patient reaches 34 ºC, set to GRADUAL mode at 33 ºC.
   b. Blue Faced Gaymar Unit (MTA 7900): Automatic mode with target temperature of 33 ºC
   c. If Target Temperature not reached within 4 hours:
      i. Contact house officer
      ii. Add ice packs to groin and axillae
      iii. Additional 500 ml boluses of cold (4 ºC) NSS may be ordered
   d. If Target Overshoot (< 32 ºC)
      i. Contact house officer
      ii. Cooling device will actively warm patient in AUTOMATIC mode
      iii. Additional warming measures may be needed if temp <31 ºC (warm IV fluids, blankets, heat lamp) until temp increases to >32 ºC

WARMING
1. Re-warm gradually (no more than 0.5-1ºC per hour)
   a. Re-warm to set point of 37ºC and maintain paralysis until patient reaches 36ºC
   b. Gray-Faced Gaymar Unit (MTA 6900)
      i. Set in AUTOMATIC mode, GRADUAL
      ii. Manually increase target temperature setting by 0.33 ºC every 1 hour until patient reaches 36 ºC
      iii. Discontinue cooling system when 36 ºC is reached.
   c. Blue Faced Gaymar Unit (MTA 7900)
      i. Set in AUTOMATIC mode, MODERATE with target temperature of 37 ºC. This will re-warm patient at 0.33 ºC/hr.
      ii. Do not change from AUTOMATIC to MANUAL mode during re-warming – this will re-set the re-warming algorithm
      iii. If the patient is re-warming faster than the machine allows, notify MD and consider etiology of more rapid warming (i.e. fever).
      iv. Discontinue cooling system when patient temperature reaches 36 ºC
What is the Difference Between the Two Units?

- **Blue Faced Machine MTA 7900**
  - Internally changes to the GRAUDUAL mode during cooling when the patient’s temperature gets within 1 degree of the set point.
  - At 34 °C, automatically slows down cooling so less chance of overshoot
  - During re-warming, automatically increases the temperature 0.33 °C every hour when in MODERATE MODE
  - If set on GRADUAL MODE for re-warming, re-warms at a rate of 0.17 °C every hour
  - If patient starts re-warming too quickly or if temperature is dropping, the machine will alert you

- **Gray Faced Machine**
  - Requires you to manually change to the GRADUAL mode during cooling when pt. temp gets to 34 °C
  - You need to manually increase the temperature every hour during re-warming
Appendix C

Gaymar® Rap R Rounds™ Standard Hose Hook-up

2008 Gaymar Industries, Inc.
APPENDIX D:

Train of Four Algorithm for Therapeutic Hypothermia Patients

*Continue to decrease dose by 10% until evidence of shivering is present or minimum recommended dose in dosing range is reached. Do not discontinue drug.