POLICY STATEMENT: Clinically induced hypothermia is an evidenced based strategy utilized to improve the neurological outcome of an unconscious patient following sudden cardiac arrest. By lowering the brain temperature it decreases metabolic demand and ischemic changes in the brain.

Criteria for therapeutic hypothermia after cardiac arrest are based on the 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.

Inclusion Criteria:
- A witnessed arrest (initial rhythm of VF, pulseless VT, PEA, asystole)
- Maximum of 15 minutes to first resuscitation attempt
- Less than 60 minutes from collapse to Return of Spontaneous Circulation (ROSC)
- Age of 18 years or older
- Women with a negative pregnancy test
- Unconscious adult at time of coding. (Coma is defined as: not following commands, no speech, no eye opening, and no purposeful movements to noxious stimuli. Brainstem reflexes and pathological/posturing movements permissible).
- Able to maintain a blood pressure with or without vasopressors.
- In-hospital arrests who meet the criteria at the discretion of the physician (according to ILCOR)

Exclusion Criteria:
- Known “down time” of no resuscitation efforts > 15 minutes or unknown down time
- Pregnancy
- Other causes of coma ie: drug overdose, head trauma, hemorrhagic stroke, status epilepticus
- Known pre-existing coagulopathy or active bleeding
- A known terminal illness preceding arrest
- Pre-existing DNR status with no intubation as part of resuscitation efforts
- Major surgery within the past 14 days (increased risk of infection and bleeding)
- Infection or sepsis

PROTOCOL:
- Patient should be identified as soon as possible by meeting the above criteria. For out-of-hospital arrests, ED physician will make decision to implement protocol. For in-hospital arrests, critical care physician and/or cardiology will make decision to implement protocol.
- If out-of-hospital arrest that meets criteria, the ED will insert large bore peripheral IV’s, insert temp probe foley cath and initiate consults to pulmonology and cardiology. A CT scan of the head will be considered prior to admission to the ICU. A patient deemed a candidate for reperfusion therapy will go emergently to the cath lab. CT scan of the head can be done after reperfusion therapy if deemed necessary by the cardiologist. The ED will also notify the ICU of HACA. If patient is going to cath lab immediately, HACA may be initiated in the ED and continued in the cath lab and/or ICU or delayed for up to 6 hours after ROSC, although initiating HACA as soon as possible has led to improved outcomes.
• Patient needs to have an arterial line placed as soon as possible for blood pressure measurements as well as for drawing blood.
• Patient needs to be intubated.

• A thorough initial assessment needs to be completed including neuro assessment, and skin assessment.

• Time frame: If patient meets criteria HACA should be initiated as soon as possible for 24 hours. The patient is cooled to a goal temp of 33°C (91.4°F). The 24 hour time period is from the time of initiation of cooling NOT when the target temp is reached.

• Cooling methods include intravascular temperature management (IVTM) cooling and surface cooling. IVTM therapy is the first-line of induced hypothermia cooling. Additionally, consider IV infusion of 4°C NSS over 30 minutes. Infuse up to 30ml/kg for a total of 2 L. Do not use a central line for cold infusion, use large bore peripheral IV’s or femoral line only.

• Initiate ZOLL IVTM therapy. Place Quattro catheter in ED or Cath Lab. Quattro catheter can be placed by any physician or licensed practitioner trained in central line catheter placement using full aseptic technique via femoral venous access. The Quattro catheter also contains a three port central venous catheter for IV infusion. The triple lumen catheter (TLC) is not power injectable (max 100psi). Setup of ZOLL Thermogard XP and priming of start-up kit with saline will occur in ICU or Cath Lab. Catheter is found in the Cath Lab

• After Quattro catheter placement, connect catheter to Thermogard XP for therapy initiation. Set Thermogard XP to MAX COOLING for goal of 33°C (91.4°F) for rapid cooling of patient.

• If unable to use IVTM therapy, initiate surface cooling using the Gaymar cooling equipment. Initiate the protocol by applying ice packs to the neck, axilla and groin in addition to cold saline infusion if applicable. May place fan in room and room thermostat can be turned off. Use vest and leg wraps if available, if not, use 2 cooling blankets, one on top of the patient, and one under the patient. Remember if using the 2 blanket approach to be conservative in moving blankets, as the air that is trapped between the blanket and the patient acts as a cool insulator in which the cool air can escape. Connect Foley catheter temperature probe to the Gaymar Cooling System to monitor temperatures. Once the patient reaches 33.5°C (92.3°F) may start to remove ice packs and adjust Gaymar cooling machine accordingly. May use rectal probe if anuric. Foley temp is slaved to the Gaymar cooling device and second temp source is slaved to Temp #2 on the central monitor.

• For both therapies, two sources of core temperature should be monitored at all times. Core temp may be monitored via Foley catheter, rectal probe or esophageal probe. Maintain temps within 1.5°C. If larger discrepancies occur, troubleshoot temperature sources. Use the Foley catheter temperature for documentation unless urine output is inadequate (<30ml/hr). Foley catheter temps can be inaccurate if patient has inadequate urine output. Rectal probe temperature can be inaccurate due to dislodgement and stool.

• Temperature must be monitored every 15 minutes until goal temperature achieved to prevent excessive hypothermia. Record temperature in E-Chart under HACA Temperatures in the VS/I&O CRV. DAS Vitals for Temp #2 charts temps in Celsius.

• Sedate patient per order, and administer scheduled Buspirone and Vecuronium as needed for shivering for a goal Bedside Shiver Assessment Scale (BSAS) of ≤ 1 {See scale below}. Shivering should be prevented as it can increase metabolic activity and oxygen consumption. Shivering should be assessed and documented hourly using the BSAS scale. With IVTM therapy, surface counter-warming measures should be initiated to prevent shivering. Apply warm blankets and/or Bair Hugger to extremities (not core) to prevent shivering.
• VS: BP, MAP, HR, O2 sat every 15 minutes x 4 then every 30 minutes x 2 then hourly and prn. Keep MAP >80 & <110 and SBP >100mmHg for adequate cerebral perfusion. Typically BP will remain elevated during hypothermia due to vasoconstriction and will drop during the re-warming phase. Bradycardia is a result of hypothermia.

• Monitor electrolytes. High normal levels of Magnesium are recommended during cooling because magnesium has neuroprotective properties. Cooling shifts potassium into the cells causing low serum potassium levels. While re-warming it shifts back into the serum. Stop all potassium replacements during the re-warming phase to prevent rebound hyperkalemia. Follow electrolyte replacement protocol on order set. See Hypothermia After Cardiac Arrest (HACA) Orders

• ABG’s must be analyzed at patient’s actual body temperature. Send blood gases to lab with patient’s core body temp written on the label.

• Blood cultures to be obtained at 12 hours. The patient’s immune response will be suppressed during hypothermia. The WBC count will be decreased and cooling masks fever.

• Monitor and document Bedside Shivering Assessment Scale (BSAS) hourly. Treat BSAS >1 using ordered non-pharmacological and pharmacological methods. To appropriately utilize the BSAS: Start with palpation of the patient’s neck, masseter and chest muscles to determine if shivering is present. Micro-shivering (BSAS=1) can be detected by palpation before it is visible and may be felt as a humming or vibration. Moderate shivering involves the neck, chest muscles and involvement of upper extremities (BSAS=2). Severe shivering is seen with movement of the neck, chest and all extremities (BSAS=3).

<table>
<thead>
<tr>
<th>Score</th>
<th>Type of Shivering</th>
<th>Location of Shivering</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>None</td>
<td>No shivering is detected on palpation</td>
</tr>
<tr>
<td>1</td>
<td>Mild</td>
<td>Shivering localized to neck and/or chest only</td>
</tr>
<tr>
<td>2</td>
<td>Moderate</td>
<td>Shivering involving gross movement of upper extremities, neck &amp; chest</td>
</tr>
<tr>
<td>3</td>
<td>Severe</td>
<td>Intermittent to constant generalized shivering involving gross movements of the trunk and all four extremities.</td>
</tr>
</tbody>
</table>

• Non-pharmacological methods of shiver treatment include:
  • Localized warming of the hands and feet using socks or hand warmers.
  • Use of blanket or warm blanket.
  • Use of warming device to extremities, such as Bair Hugger.
• Pharmacological methods for treatment of shivering include:
  • Sedation with Versed, Propofol, Fentanyl drips.
  • Scheduled Buspar po.
  • PRN Demerol or Vecuronium boluses.

• Good pulmonary care and oral care for prevention of pneumonia as this type of patient is at increased risk for aspiration pneumonia.

• Assess skin for breakdown and minor frost bite due to decrease in circulation and peripheral vasoconstriction. Follow the Adult Insulin Drip Protocol if ordered. Hyperglycemia is a side effect of hypothermia caused by insulin resistance. Hyperglycemia is associated with an increased risk of infection, renal failure and critical illness neuropathy.

• Because of peripheral vasoconstriction during hypothermia, train of four and BIS monitoring may present with difficulties and are considered unreliable. (There is no defined twitch response to prevent shivering.)

• Monitor for signs and symptoms of coagulopathy. Mild hypothermia displaces platelet function, causing an increased risk of bleeding.
• Do not bathe patient during cooling or re-warming phase as this will allow for fluctuation in patient temperature.

• If significant dysrhythmias, hemodynamic instability, or bleeding develops notify physician immediately. Active cooling should be discontinued and the patient should be re-warmed per protocol.

Nursing Considerations:
• I&O hourly and call if < 30 ml/hr x 2 hrs
• NGT/OGT to LIWS should be placed if able.
• Donor alliance should be notified for HACA patients within one hour of HACA protocol initiation.

Re-warming phase general considerations to be used in conjunction with appropriate therapy below:
• Stop potassium replacements and notify Pharmacy.
• Stop Buspirone when temperature reaches 36.5°C (97.7°F)
• Continue paralytic (vercuronium) until temperature reaches 36.5°C (97.7°F), then discontinue.
• Monitor and document temperature every 15 minutes until target temp reached. Monitor and document other vital signs every 30 minutes until target temp reached.
• Apply SCD’s once temperature reaches 36.5°C.
• Administer Tylenol as needed for temp > 37°C. Do not permit hyperthermia.
• Monitor for potential complications: arrhythmias, infection, coagulopathies, rebound hyperkalemia, rebound hyperthermia, status epilepticus and hypotension.

Re-warming phase for the ZOLL IVTM Cooling system to be used in conjunction with general considerations:
The re-warming phase should begin 24 hours after the initiation of cooling. Not 24 hours after target temperature was reached.
• Goal temp in 36.5°C (97.7°F)
• Set Thermogard XP to “Controlled Rate” at 0.2°C per hour. The machine will automatically cease re-warming when goal temp is reached.
• Continue normothermia at 36.5°C with Thermogard XP for 24 hours. If the trending graph of the machine is essentially flat and the patient’s temp has not increased, discontinue IVTM therapy 24 hours after re-warming goal temp of 36.5°C reached.

Re-warming phase for the Gaymar Surface Cooling system to be used in conjunction with general considerations:
The re-warming phase should begin 24 hours after the initiation of cooling. NOT 24 hours after target temperature was reached.
• Goal temp is 36.5°C (97.7°F)
• Re-warm slowly at a rate of 0.2°C – 0.3°C (0.4° - 0.5°F) every hour.
• If problems occur during re-warming process,(overshoot or undershoot) put Gaymar machine in automatic mode and rapid. Set your set point 0.5°C higher and increase every 3 hours for a total of 18 hours.
• Stop re-warming process when temperature reaches 36.5°C to prevent hyperthermia.
• Remove all cooling devices. May use warm blankets but not Bair Hugger blanket. Return room temperature to normal.
REFERENCES:


7. RN Web, The Big Chill: Improving the odds after cardiac arrest, May 1, 2005,


9. Kozik,T. Induced Hypothermia for Patients with Cardiac Arrest, Role of the Clinical Nurse Specialist, Critical Care Nurse Volume 27, Number 5, October 2007, pp 36-42


12. Review of Protocols and orders from: University of Pittsburgh, Chicago, Maine, Massachusetts General Hospital, San Francisco General Hospital, Boulder Community Hospital, and University of Colorado Health Memorial Hospital.

See: Hypothermia After Cardiac Arrest (HACA) Orders
Identify patient meeting criteria
  o Meets inclusion criteria.
    □ A witnessed arrest
    □ Maximum of 15 minutes to 1st resuscitation attempt
    □ Less than 60 minutes from collapse to Return of Spontaneous Circulation (ROSC)
    □ Age of 18 years or older
    □ Women with a negative pregnancy test
    □ Unconscious adult at time of cooling
    □ Able to maintain blood pressure with or without vasopressors
    □ In-hospital arrests who meet the criteria at the discretion of the physician
  o Exclusion criteria includes:
    □ Known “down time” of no resuscitation efforts >15 minutes or unknown down time
    □ Pregnancy
    □ Other causes of coma, ie: drug overdose, head trauma, hemorrhagic stroke, status epilepticus
    □ Known pre-existing coagulopathy or active bleeding
    □ A known terminal illness preceding arrest
    □ Pre-existing DNR status with DNI
    □ Major surgery with the last 14 days
    □ Infection or sepsis
  o Copy of HACA protocol from Clinical Forms located on the Grove homepage under Clinical Services in hand as reference.
  o Document:
    Time of arrest ____________
    Time of initiation of resuscitation efforts ________________
    Time of Return of Spontaneous Circulation ______________
    Time of initiation of cooling _______________________
    Initial core temp __________________________
  o ED is responsible for notifying the intensivists (Dr. Vanhook, Delgado or Tangel).
  o Patient must be intubated. Sedation as ordered.
  o Notify shift manager and ICU of potential HACA patient
  o Insert 2 large bore IV’s
  o Draw Stat Labs: CBC, CMP, Mag, Phos, PT/INR, PTT, fibrinogen, d-dimer, Troponin, CK CKMB, lactate, ionized calcium, HCG (pregnancy test on all women under 50), ABG Urine drug tox screen
  o Stat PCXR, EKG
  o Stat CT scan of head to r/o hemorrhage. **Unless deemed UNNECESSARY by cardiologist.**
  o Insert foley cath with temperature probe. Check patient’s temperature. Goal temp of procedure is
  o 33°C (91.4°F) Insert NG/OG. Should be placed in ED because of increased risk of bleeding with cooling.
  o Call report to ICU.

The ED RN will notify the ICU of the HACA pt. The ICU will then begin to set the room up to accommodate patient and will adjust staffing pattern as these patients are 2:1 initially. When the room is ready, if ICU is able they will send RN to ED to assist if needed.
After report is called the ICU will notify the intensivists that the patient is on the way to ICU so they can come and place arterial line and/or central line.