University of Virginia Medical Center
Clinical Practice Guideline

Adult Therapeutic Hypothermia after Cardiac Arrest

Note: The decision to initiate cooling and the method to be used is determined by the ED attending, CCU attending/fellow or MICU attending/fellow.

Inclusion Criteria:
1. Cardiac arrest with return of spontaneous circulation
2. Unresponsive after return of spontaneous circulation
3. Age > 18 years
4. Mechanical ventilation as a result of resuscitation efforts
5. Blood pressure can be maintained at ≥ 90 mm Hg systolic either spontaneously or with fluid and/or vasoactive agents
6. No limit on duration of resuscitation from pulseless state is suggested
7. Less than 6 hours since return of spontaneous circulation

Exclusion Criteria:
1. Other alternative clinical conditions causing the patient to be comatose (e.g., drugs, sepsis, head trauma, stroke, overt status epilepticus)
2. Trauma
3. Pregnancy in third trimester
4. Temperature of < 30° C following arrest
5. Unstable blood pressure or rhythm unresponsive to therapy
6. Known or preexisting coagulopathy or active bleeding
7. Not requiring mechanical ventilation as part of resuscitation efforts.
8. Patients who have a known pre-arrest terminal illness
9. Patients who are alert and oriented following the initial arrest

Preparation
- Ensure appropriate orders in MIS.
- Obtain baseline labs, including basic metabolic panel, CBC and coagulations studies (PT, aPTT).
- When in a single patient room and whenever possible, turn room thermostat to lowest setting.
- Determine availability of intravascular temperature management system (console and appropriate catheter; located in NNICU, CCU, MICU)
  - Determine presence of IVC filter. If no IVC filter, MD to insert intravascular cooling catheter via femoral approach.
  - If IVC filter present, consider use of intravascular cooling catheter via internal jugular or subclavian approach. Adjunctive cooling methods will be necessary during initiation of cooling.
- If an intravascular temperature management system is unavailable, obtain equipment for surface cooling. (Note: One console and two hose sets should be ordered from the Equipment Room.)

Procedure
Note: Document post resuscitation neurologic examination by MD in the medical record prior to patient cooling. A neurology consult should be considered, but should not delay the initiation of cooling.
- Initiate cooling as early as possible with a core temperature goal of 32 - 34° C. The goal temperature should be reached as rapidly as possible (less than 4 hours).
- Initiate the cooling process using 2 liters of 4°C NS administered rapidly (pressure bag) through either a femoral catheter or peripheral venous catheter. Not indicated if the patient has documented pulmonary edema.
- Apply ice packs to the armpits, torso, limbs and beneath neck.
- If an intravascular temperature management system is available and is the method chosen, follow steps in Temperature Control Using an Intravascular Cooling System [PNSO Critical Care Procedure Manual, procedure 95A].
Once goal temperature is obtained, remove ice bags and maintain temperature with intravascular temperature management system.

- If an intravascular temperature management system is not available or is not chosen, follow Procedure for Induced Hypothermia after Cardiac Arrest Using Surface Cooling [PNSO Critical Care Procedure Manual, procedure 95B].
- Do not use warm humidification on the ventilator during the period of therapeutic hypothermia or during re-warming.
- Initiate sedation with fentanyl and midazolam dosed as follows per MD order:
  - Fentanyl: 50 mcg IV bolus followed by a maintenance infusion of 25 to 100 mcg/hr
  - Midazolam: 2 mg IV bolus followed by a maintenance infusion of 2 to 8 mg/hr
- Patients receiving therapeutic hypothermia should NOT have an interruption of sedation (“sedation holiday”).

**Shivering management**

If shivering occurs despite sedation, the agents listed below may be utilized in the following order:

- **Meperidine (Demerol)** 25 mg IV q 3 to 4 hours as needed
  - *If patient has renal insufficiency (CrCl < 50 mL/min), reduce dose of meperidine to 12.5 mg
- **If the patient is on hemodialysis or allergic to meperidine, then consider one of the following agents:**
  - **Buspirone (Buspar)** 30 mg via gastric tube x 1 then 5 mg PO every 8 hours. Adjunctive therapies will be necessary when using buspirone.
  - **Propofol (Diprivan)** – Initiate infusion at 20 mcg/kg/min and titrate by 5 mcg/kg/min as needed.
  - **Dexmedetomidine (Precedex)** – Administer continuous infusion of 0.2 to 0.7 mcg/kg/hr. (Hold for HR < 50 bpm or SBP < 90 mmHg).
- If shivering CANNOT be controlled by any of the above methods, then a paralytic agent should be employed:
  - Bolus doses of the selected neuromuscular blocker should be attempted initially.
  - A continuous infusion of a neuromuscular blocker may be considered for those patients who continue to shiver following bolus therapy.
  - Continuous airway pressure monitoring is required for patients receiving neuromuscular blockade.

**NOTE:** Neurology consult team should be contacted immediately to assess the patient prior to initiation of neuromuscular blocking agents. However, therapy should NOT be delayed if neurology is unable to consult within 30 minutes.

**Monitoring & Documentation**

- Continuous temperature monitoring from two sources is required. One temperature shall be displayed on the bedside monitor (via the hospital monitor interface accessory) for any patient receiving therapy with an intravascular temperature management system.
- Basic metabolic labs should be obtained q 4h during active cooling and rewarming.
- Airway pressure monitoring must be used if continuous neuromuscular blockade is required.
- Neurology consultation and EEG monitoring should be considered for cases of neuromuscular blockade.
**Therapy Considerations**

- Cooling should continue for no longer than 24 hours from the initiation of therapy. The benefits of any off-unit procedures or tests should be carefully weighed against the interruption of cooling.
- Electrolyte and acid-base management: The management of electrolyte and acid base disturbances is performed with caution. In particular, serum potassium levels are monitored closely with the realization that the serum level may decrease during the cooling phase of management and increase during the rewarming period. A mild increase in lactic acid should also be expected.
- At 16 hours from the time cooling started, STOP all potassium administration (including any potassium supplements in continuous IV fluids).
- Glucose management: hypothermia can lead to increased insulin resistance.

**Rewarming**

- Begin rewarming once 24 total hours of cooling has occurred. Use a slow rewarming approach (maximum of 0.5°C/hour) to avoid rebound hyperthermia. Return room thermostat to normal temperature.
- Discontinue neuromuscular blocking agents (if used). Pharmacologic intervention may be necessary for shivering during the rewarming phase of therapy to prevent rapid rewarming and its sequelae.
- Titrate analgesics and sedatives for patient comfort until patient is rewarmed to 36.5°C
- Maintain patient at 36.5°C with the intravascular temperature management system for the next 12 hours. Discontinue active temperature maintenance (place intravascular temperature management system in ‘standby’) but continue monitoring temperature for another 12 hours before removal of the intravascular cooling catheter.

**Urgent cessation of therapeutic hypothermia:** Patients with suspected sepsis or who develop hemodynamic or cardiac electrical instability should be withdrawn from the cooling guideline.

**Stop cooling and notify MD:**
- Ventricular tachycardia or fibrillation
- Asystole
- Sustained SVT
- Refractory hypotension (defined by the need for more than 2 vasopressors)

Clinical decision tools are general and cannot take into account all of the circumstances of a particular patient. Judgment regarding the propriety of using any specific procedure or guideline with a particular patient remains with that patient’s physician, nurse or other health care professional, taking into account the individual circumstances presented by the patient.

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