GUIDELINES FOR NORMOTHERMIA- Tipsheet

Goals: To induce normothermia in brain-injured patients with fever refractory to conservative treatment by using external surface cooling or catheter-based cooling methods.

Patient Eligibility:
1. Presence of fever (T ≥ 101.5°F / T ≥ 38.6°C) that is refractory to conservative measures, including: acetaminophen 650mg, cooling blankets, and ice packs within 2 hours of fever onset.
   a. Refractory indicates failure to reduce fever below 100.5°F (38°C), or recurrence of temperature ≥ 100.5°F within four hours of initiation of conservative measures.
2. Patient must have undergone appropriate infectious disease work-up for fever source and initiation of antimicrobial therapy if indicated.
3. Exclusion Criteria:
   a. Contraindications to induced temperature reduction: known hematological dyscrasias which affect thrombosis (cryoglobulinemia, sickle-cell disease, serum cold agglutinins)
   b. Diagnosis of sepsis syndrome
   c. Active cardiac dysrhythmia with hemodynamic instability
   d. For external surface cooling methods (Arctic Sun):
      ➢ Preexisting skin condition that precludes the use of adhesive cooling pads
   e. For catheter-based cooling methods:
      ➢ Known deep venous thrombosis
      ➢ Previously placed IVC filter
      ➢ Contraindication for central venous catheter placement
      ➢ Known or suspected diagnosis of heparin induced thrombocytopenia

Procedure:
1. The nursing staff will identify all patients with refractory fever. The Attending Physician or designee will decide on the most appropriate cooling modality. A rectal temperature probe will be placed in patients needing MRI. A bladder temperature probe may be used in patients NOT needing MRI (foley probe is not compatible with MRI). Either external surface pads or a central venous accessed cooling catheter will be placed. Target temperature for normothermia will be set at 97.7°F-99.5°F (36.5°C – 37.5°C). Ventilator warming device temperature will be maintained at ≤ 98.6°F (37°C). Tylenol will be administered 650 mg q4hrs x 72hrs. Body temp and water bath temp documented with each recording of vital signs (at least q2 hours – interval may increase with increased acuity of patient).

2. Baseline cultures: blood, urine, sputum, and CSF (if applicable) will be sent to detect infection at institution of cooling therapy. WBC will be followed daily during the period of induced normothermia. A rise in the WBC by 20% from the time of initiation of induced normothermia is considered significant and will prompt an infection workup. Additional cultures will be sent every 72 hrs if an infectious source is suspected but not identified. The need for additional cultures prior to 72 hrs is left to the discretion of the treating intensivist.

3. Normothermia will be maintained continuously for a period of up to 72 hrs with either a catheter based system or surface jacket at which time the need for ongoing temperature control will be reassessed. Should the patient subsequently develop a refractory fever over the next 24 hrs, re-induction of normothermia will be considered and left to the discretion of the Critical Care/ Neuro-Critical Care team.

4. Review anti-epileptic regimen. Change therapy to Keppra (500 to 1500 mg q 12 hours) as directed by Critical Care/ Neuro-Critical Care team, if patient is currently taking phenytoin or phenobarb. Phenytoin and phenobarb are theorized to promote the breakdown of meperidine to normeperidine, potentially lowering the seizure threshold.
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5. Shivering may be encountered while maintaining normothermia. The Shivering Management protocol will be instituted as follows:

**Shivering Management Protocol:**

<table>
<thead>
<tr>
<th>Non-Pharmacologic Methods: To be used first</th>
<th>Pharmacologic Methods: To be used if non-pharmacologic methods are unsuccessful in reducing shivering.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bair Hugger applied to exposed skin</td>
<td><strong>Buspirone:</strong> 15-30 mg every 8 hours prn; <strong>MAX dose:</strong> 60 mg/day.</td>
</tr>
<tr>
<td>Hand-warming- Instant Hot Packs x 1 hr</td>
<td><strong>Meperidine:</strong> 12.5 mg IV, repeat x 1 in 5 minutes if not effective. May be given q 6 hours. Maximum dose = 100 mg/day. Maximum cumulative dose = 300 mg.</td>
</tr>
</tbody>
</table>

**Contraindications:**
- **Not to be used in patients with documented renal insufficiency defined as a Cr Clear < 50ml/min**
  
  *Cockcroft-Gault Cr Clearance:*
  - Male: \[140 - (\text{Age}) \times \left(\frac{\text{Wt}}{\text{Cr mg/dl}} \times 72\right)\]
  - Female: \[140 - (\text{Age}) \times \left(0.85 \times \frac{\text{Wt}}{\text{Cr mg/dl}} \times 72\right)\]

- **Contraindicated with concomitant use of MAO Inhibitors (within 2 weeks).**

**Clonidine:** Only appropriate patients (Hypertensive)

**Vented patients:** Continuous infusion sedative-hypnotic agents (diprivan + fentanyl)

**Consider Paralytics only as last resort.**

**Shivering/Rigors/Chills Events:**

1. RN will document, every 2 hours on flowsheet, evidence of shivering/rigors/chills using both tactile and visual assessment according to the Holtzclaw shivering scale (See Below).
2. Daily documentation of shivering events will include incidents of shivering, methods to induce cessation of shivering, time to cessation, breakthrough events.
3. Documentation of physiologic data will include (if present and applicable): PbtO2, SjvO2, SaO2, ICP, CPP, HR, MAP
4. Meperidine (Demerol) dosing will be tabulated daily noting 24 hour and cumulative mg total on flowsheet as well as daily progress note.
5. EEG or clinical evidence of seizure activity: Meperidine dosing will be discontinued.

**Holtzclaw Shivering Scale:**

- 0 = no visible or palpable shivering
- 1 = palpable mandible vibration or EKG artifact
- 2 = visible fasiculations of the head or neck
- 3 = visible fasiculations of the pectoris and trunk
- 4 = generalized shaking of the entire body and teeth chattering