



Neuroscience NICU

Therapeutic Hypothermia Guidelines

(Last Revised September 2019)



This guideline provides recommendations regarding transport, assessment, and treatment of neonatal encephalopathy. The primary management centers around therapeutic hypothermia for hypoxic-ischemic encephalopathy, although etiologies other than HIE must be considered in any infant with encephalopathy.



Transport and initial management

- If there is any question regarding the need for hypothermia, the transport team will take the Tecotherm Neo system and set up the system en route to the referring hospital (Appendix A: Setting up the Tecotherm)
- If neonate meets criteria **both** by history and by physical exam for moderate to severe encephalopathy and no contraindications exist (see eligibility section – if unclear, discuss with medical control provider) then begin whole body cooling using the Tecotherm system
- **If question remains if the baby meets criteria after discussion with MCP, set the transport incubator to 28.0°C and do not exceed rectal temperature of neonate greater than 36.5°C (and no lower than 33 °C)**
- Consider performing the following, taking into account that each clinical situation is unique and these recommendations will not always be possible or appropriate given time constraints:
 - Ensure adequate vascular access (including umbilical lines or peripheral arterial line as necessary)
 - Foley catheter, NG/OG to gravity
 - Medications/infusions
 - Dextrose 10% as maintenance fluids at 50-60 ml/kg/day (may need up to 20% to maintain GIR)
 - Antibiotics if indicated: ampicillin/cefotaxime (avoid renal-excreted antibiotics if possible)
 - Cefepime (or gentamicin with close monitoring of levels) may be substituted for cefotaxime
 - Vasoactive agents as indicated (dobutamine as first line if available, otherwise epinephrine – should avoid primary vasoconstrictors such as dopamine)¹
 - Consider iNO if impaired oxygenation
 - **Use only short-acting sedation (fentanyl) and anticonvulsant medications (lorazepam) if needed during transport**
 - Labs
 - Complete EPOC panel
 - Monitor blood sugar hourly
 - Monitoring
 - Set alarm limits on monitors to low HR = 80 and high HR = 220
 - Vital signs including rectal temperature every 15 minutes.
 - Neuro checks every 30 minutes (need penlight)
 - Handling
 - Reposition every 1 hour on longer transports to avoid skin injury and for perfusion monitoring
 - Maintain head in midline position
 - Attempt minimal handling, decreased stimulation
 - Place ear protection
 - Consider using phototherapy swaddler, if available
- **Before leaving referring hospital:**
 - Leave Encephalopathy/Hypothermia brochure with family
 - Ask the referring facility to send the placenta for pathology
- The 72-hour cooling period begins when the infant's rectal temperature reaches $\leq 34.0^{\circ}\text{C}$ (Desired range 33.0 - 34.0°C). Record on documentation.

Eligibility for therapeutic hypothermia²⁻⁷

- Gestational age ≥ 35 0/7 weeks

- Cooling may be less effective in small for gestational age infants, but there appears to be no harm⁸
- Postnatal age <6 hours
- History: (one or more of the following)
 - Cord or blood gas in 1st hour with pH less than or equal to 7.1
 - Cord or blood gas in 1st hour with base deficit greater than or equal to 12
 - Need for ventilation support beginning at birth and continuing at 10 minutes of life, including mask or ETT ventilation
 - Apgar score less than or equal to 5 at 10 minutes of life
 - Acute period of hypoxia-ischemia (i.e. cardiac arrest, severe placental abruption)
- Physical exam (must be moderate or severe to qualify for hypothermia)
 - Should be obtained more than 10 minutes after resuscitation is completed and before being cooled
 - Must have the presence of one or more abnormal signs in 3 of the 6 following categories
 - **Clinical seizures automatically qualify infant as moderate to severe encephalopathy**

| Physical Exam | Moderate Encephalopathy | Severe Encephalopathy |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Level of Consciousness | Lethargic | Stupor or coma |
| Spontaneous Activity | Decreased | No activity |
| Posture* | Distal Flexion, complete extension-Arms are flexed and legs extended, fingers, toes and thumbs in strong flexion  | Decerebrate- Legs and arms are extended with the wrists flexed and hands fisted  |
| Tone | Hypotonia (focal or general) | Flaccid |
| Primitive Reflexes Suck Moro | Weak Incomplete | Absent Absent |
| Autonomic system Pupils Heart Rate Respiration | Constricted Bradycardia Periodic breathing | Deviated, dilated or non-reactive Variable Apnea |

*Images adapted from Fletcher's Physical Diagnosis of Neonatology⁹

- Relative contraindications
 - Life-threatening congenital anomalies, infant not expected to survive transport
 - Severe pulmonary hypertension or use of inhaled nitric oxide
 - Difficulty in controlling active bleeding, DIC, coagulopathy
 - Known intracranial hemorrhage or stroke

Neuroimaging for neonatal encephalopathy

- Head ultrasound should be obtained immediately upon admission to assess for non-HI causes of encephalopathy and potential contraindications to therapeutic hypothermia
- MRI should be obtained between 24 to 72 hours after rewarming (DWI, DTI, and spectroscopy may provide false-negatives >6 days after injury)^{10,11} on all infants with encephalopathy
 - Order should specify "HIE protocol" in the comment section
 - MR spectroscopy should be added if metabolic disease is considered as a potential etiology (requires separate order, but will be performed concurrently)
- Earlier imaging (MRI or CT) may be necessary based on clinical findings

Seizure monitoring

- Neurology should be consulted in infants with confirmed seizure activity to aid in management
- All infants undergoing therapeutic hypothermia or with suspected seizures should undergo continuous monitoring^{12,13,14}:
 - 24 hours of full-montage video EEG upon admission (obtain HUS prior to placing EEG leads)
 - Should continue until seizure free for >12 hours
 - May consider <24 hours if no seizure activity and reassuring background for first 12 hours
 - aEEG throughout the remaining hypothermia and through rewarming

Laboratory assessment

- Lab choice and frequency should be targeted to reflect the infants’ clinical status
- An example of labs to be drawn and their frequency for a typical infant with HIE is presented below:

| Admission | Q4H (until stable) | Q8H (until stable) | Daily in AM (until stable) |
|--------------------------------------|---------------------------|---------------------------|-----------------------------------|
| Chem 14 | ABG with lactate | Chem 8 | Chem 14 |
| Mag/Phos | Blood glucose | Ionized calcium | Mag/Phos |
| CBC w/ diff | | Coags (PT/PTT/INR/fib) | CBC w/diff |
| Coags (PT/PTT/INR/fib) | | | Triglyceride |
| Type and screen | | | *Coags (PT/PTT/INR/fib) |
| ABG with lactate | | | *CRP |
| Blood glucose | | | |
| Blood cultures (if not done) | | | |
| Placental pathology (if available) | | | |
| *Echocardiogram | | | |
| *Troponin, CK | | | |
| *CRP | | | |
| *Microarray | | | |
| *Serum amino, urine organic acids | | | |
| *Serum ammonia | | | |
| *CSF studies and/or biofire | | | |
| *HSV cultures/PCR | | | |
| *Drug screens | | | |
| *Phenobarbital level (if applicable) | | | |

* May consider obtaining these labs, based on clinical presentation

Feeding

- All infants undergoing therapeutic hypothermia should initially be NPO
- Very little data exists regarding the appropriate timing of initiating enteral feeds¹⁵
- Minimal enteral feeds may be considered after the first 24 hours of cooling if:
 - Not on any vasopressors

- Not oliguric/anuric
- Abdominal exam reassuring with no emesis
- Due to a high incidence of dysphagia and aspiration in infants after HIE,¹⁶ all infants with HIE should be evaluated by the feeding team once initiating oral feeds.

Sedation

- Normal HR for term infants undergoing TH is ~100 bpm; HR>110-120 should be considered tachycardia
- Morphine drip should be standard for pain/shivering
 - Dosing: 5-10 µg/kg/hr, as >10 µg/kg/hr may lead to toxic levels¹⁷

Rewarming

- Rewarming will begin 72 hours after first recorded rectal temperature of ≤ 34.0°C
- Rate of rewarming will not exceed 0.5°C/hour
- If seizures noted on rewarming, cool infant back to 34.5°C and restart rewarming at half the prior speed

Documentation

- Physicians/NNPs should be documenting in daily progress note:
 - aEEG tracing and trend
 - Sarnat staging
- Nursing will document
 - Any clinical seizure activity and all cares that create artifact on the aEEG device
 - Administration of anti-epileptic drugs in EPIC and on aEEG device
 - Rectal, skin, blanket temperatures in the Hypothermic Cooling Blanket Treatment Log in EPIC
 - Infant's response to therapeutic hypothermia in the nurses assessment
 - Re-warming procedure and infant's response in the nurses assessment
 - Skin appearance as needed in the skin assessment section of the NICU Assessment flowsheet in EPIC

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