
ALASKA NATIVE MEDICAL CENTER NICU GUIDELINES

Initial Management of Neonatal Hypoxic-Ischemic Encephalopathy (HIE)

Neonates born at ANMC with HIE must be rapidly identified as hypothermia candidates and have emergent transport arranged. While waiting for the transport team to arrive, these neonates often require intensive stabilization and preparation for initiation of hypothermia at the tertiary care center.

PURPOSE

To provide criteria to recognize neonatal hypoxic-ischemia (HIE), determine hypothermia candidacy of neonate, and appropriately support infant clinically until transport occurs.

INCLUSION CRITERIA FOR HYPOTHERMIC THERAPY (WHOLE BODY COOLING)

1. Gestational Age ≥ 35 weeks
2. Birth weight ≥ 1800 grams
3. Less than 6 hours since birth (or time of insult) at start of cooling
4. Seizures or exhibiting signs of moderate/severe HIE
5. One or more of the following predictors of severe HIE:
 - a. Blood gas pH < 7 or base deficit of > 16 (obtained within first hour)
 - b. No blood gas or blood gas pH 7-7.15 or base deficit of 10-15.9 with an acute perinatal event and either:
 - A 10 minute Apgar less than 5, AND/OR
 - Assisted ventilation at birth required for ≥ 10 minutes

Infant must meet both physiologic and neurologic criteria:

- A. Physiologic criteria
 1. Blood gas pH < 7 or base deficit of > 16 , then proceed to neurologic criteria (Blood gas is defined as (A) a cord gas, or (B) any blood gas *within the first hour of life.*)
 2. No blood gas or blood gas pH 7-7.15 or base deficit of 10-15.9 with an acute perinatal event (abruption placenta, cord prolapse, severe FHR abnormality: variable or late decels), plus either a or b, then proceed to neurologic criteria.
 - a. A 10 minute Apgar less than 5
 - b. A continued need for ventilation initiated at birth and continued for at least 10 minutes
- B. Neurologic Criteria
 1. The presence of seizures is automatic inclusion
 2. Physical exam consistent with moderate to severe encephalopathy in 3 of the 6 categories listed in Neurologic Criteria Box

Neurologic Criteria Box

	Neuro Exam	Moderate Encephalopathy	Severe Encephalopathy
1	Level of consciousness	Lethargic	Stupor or coma
2	Spontaneous movement	Decreased activity	No activity
3	Posture	Distal flexion	Decerebrate
4	Tone	Hypotonia (focal, general)	Flaccid
5	Primitive Reflexes: Suck Moro	Weak Incomplete	Absent Absent
6	Autonomic System: Pupils Heart Rate Respiration	Constricted Bradycardia Periodic Breathing	Dilated, nonreactive Variable Apnea

Exclusion Criteria:

1. Gestational Age <35 weeks
2. Birth weight <1800 grams
3. Unable to initiate body cooling within 6 hours (12 hours max)
4. Relative contraindications (at discretion of Neonatologist/Pediatrician)
 - a. Severe PHN (Pulmonary hypertension should be managed aggressively and with maximum therapy. Hypothermia should be discontinued if infant still has significant fetal circulation and/or cardiovascular instability on maximum therapy).
 - b. Severe hemodynamic compromise
 - c. Severe coagulopathy with active bleeding
 - d. Presence of major congenital anomaly/chromosome anomaly

TRANSPORT PREPARATION RECOMMENDATIONS FROM TERTIARY CENTER

1. Eligible infants' should not be actively cooled prior to arrival at tertiary center.
2. Initiate Passive Cooling if directed by Provider
 - a. Turn off all external heat sources
 - b. Monitor rectal temperature intermittently with rectal thermometer inserted 2 cm every 15 minutes (target temp = 33.5 degrees C or 92.5 degrees F)
3. If temp falls below 33.5 degrees C, restart heat sources at lowest settings. Avoid overcooling.
4. Secure vascular access as directed (umbilical catheter if requested by accepting facility, peripheral IV at minimum) and support with fluids (usually D10W at 80 ml/kg/day or less)
5. Keep umbilical cord longer if no UVC/UAC has been placed. Keep cord moist with normal saline soaked gauze (makes it easier for MD to place UVC/UAC later).
6. Send blood cultures and start antibiotics (amp/gent) if ordered.
7. Phenobarbital for clinical seizures when ordered (usually 20 mg/kg IV load, repeat once prn seizures)
8. Monitor electrolytes and maintain within normal ranges (Ca, K, Mg, glucose) as directed
9. Avoid over-ventilation and over-oxygenation
 - a. Target PCO₂ = 45-55
 - b. Target PaO₂ = <100 mmHg and oxygen saturations <98%

10. Tolerate HRs <100 BPM in cooled patients as long as blood pressures and oxygenation remain normal.

Temperature Conversion Table

Celcius	Fahrenheit
38.0	100.4
37.0	98.6
36.0	96.8
35.0	95.0
34.0	93.2
33.0	91.4
32.0	89.6
31.0	87.8
30.0	86

ASSESSMENT/MONITORING UNTIL TRANSPORT

Respiratory: Risk for apnea, cyanosis, severe distress. Monitor SaO₂ and respiratory status. Avoid hyperventilation. Avoid hyperoxia to protect fragile neuronal tissue from oxidative stress and free radical production.

Cardiovascular: Risk for cardiovascular instability: bradycardia, sluggish capillary refill, weak pulses, pallor or cyanosis, hypotension (MAP <40 mmHg). Impairment of cerebral autoregulation necessitates frequent monitoring of blood pressure. May need fluid bolus or medication support.

Fluid Management: May need central access and ↑ dextrose concentration to maintain an adequate glucose infusion rate. Fluid overload may worsen cerebral edema. Infant is at risk for acute renal failure.

Glucose Management: Risk for hypoglycemia d/t accelerated use of glycogen stores. Perinatal asphyxia may also result in hyperinsulinemia (will impair hepatic glucose production and increase the uptake of glucose by peripheral tissue, thus contributing to cerebral energy depletion). Avoid hyperglycemia also.

Feeding Strategy: Risk for necrotizing enterocolitis (NEC) and multi-organ system dysfunction. NPO.

Hypothermia: Must start within 6 hours of injury. Avoid hyperthermia. Use of mild hypothermia will minimize systemic adverse effects while continuing to provide a degree of neuroprotection. Goal to maintain core temperature near the target range until transport arrives and active cooling can be initiated safely.

Seizure Management: Report all neonatal seizure activity immediately to Provider. Document time, length and nature of seizures. Provider may order antiepileptic medication and EEG.

Sepsis Management: Neonates with HIE may present with symptoms of septic shock. Until sepsis has been ruled out, the Provider may order antibiotics. Antimicrobial therapy is especially important when there is evidence of chorioamnionitis or other infection.

REFERENCES:

AWHONN. (2014). The neurologic system. *NOEP 3rd Edition Module VIII*.

Kasdorf, E. & Perlman, J.M. (2013). Hyperthermia, inflammation, and perinatal brain injury. *Pediatric Neurology, (49)*, 8-14.

National Association of Neonatal Nurses. (2014). Hypoxic ischemic encephalopathy and hypothermia. Hypoxic ischemic encephalopathy: Information for parents. *Baby Steps To Home*, 229-231.

National Association of Neonatal Nurses. (2011). Procedure: Hypothermia, induced Level III nurseries. *Policies, Procedures, and Competencies for Neonatal Nursing Care*, 85-93.

PAMC NICU. (2016). Neonatal whole body cooling guidelines – Blanketrol.

Sussman, C. B. & Weiss, M. D. (2013). While waiting: Early recognition and initial management of neonatal hypoxic-ischemic encephalopathy. *Advances in Neonatal Care, 13(6)*, 415-423.

Written: 11/17

Reviewed:

Revised: