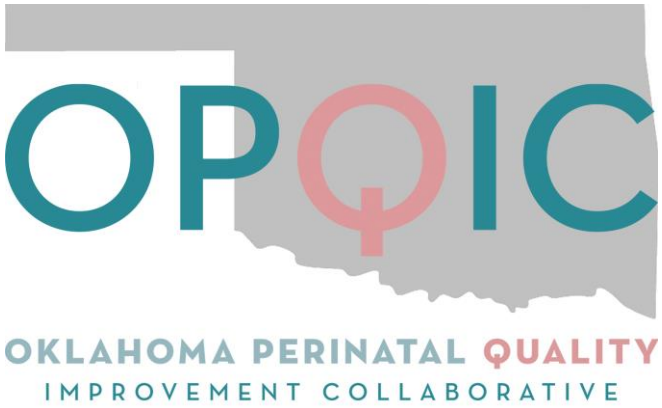

Early Identification and Screening of Neonates At-Risk for Neonatal Encephalopathy

Oklahoma HIE Task Force, OPQIC 2023

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Introduction

The Oklahoma HIE Task Force was assembled to develop state-wide guidelines for the identification and screening of infants at-risk for neonatal encephalopathy. Using the most recent evidence-based information, the task force worked to create a guiding document to ensure all newborns across Oklahoma have the opportunity to receive life-saving treatment at a skilled Oklahoma Neonatal Intensive Care Unit.

We would like to acknowledge the contribution of the members of the Oklahoma HIE Task Force and the Oklahoma Perinatal Quality Improvement Collaborative staff for their work toward our common goal of improving outcomes of newborns with neonatal encephalopathy.

HIE Highlights for Medical Providers

Diagnosis of HIE

- Neonatal encephalopathy comprises a clinical syndrome of neonatal brain dysfunction that occurs within the first few days of birth in babies at 35 weeks gestation or greater. Hypoxic ischemic encephalopathy (HIE) is the most common cause of neonatal encephalopathy and occurs due to hypoxic injury to the brain after perinatal asphyxia.
- Incidence is 1.5 per 1000 live births.
- Recognition of HIE
    - History of sentinel event around birth to suggest asphyxia.
    - Abnormal fetal heart tracing during labor and delivery
    - Surrogate markers of asphyxia include:
        - Low Apgar scores and continued need for resuscitation.
        - Poor cord gases
        - Acidosis
    - Abnormal examination that includes changes in level of consciousness, seizures, respiratory depression, hypotonia, decreased reflexes
- Pathophysiology of brain injury
    - Primary
        - Decreased cerebral blood flow results in decreased oxygen and glucose energy substrates, which leads to energy failure cascade that activates excitotoxic-oxidative cascade
        - Phase of cellular apoptosis and necrosis
    - Secondary
        - Occurs rapidly after the event
        - Continued excitotoxic-oxidative cascade leads to energy failure in mitochondria.
        - Continued brain cell death over few days to a week
    - Therapeutic window
        - Occurs between primary and secondary phases of injury
        - Lasts about 6 hours – the window for treatment
        - Determined in animal studies and supported by randomized control trials in infants

Therapeutic Hypothermia

- Evidence for use
    - The only approved therapy for treatment of HIE

    - Multiple randomized control trials have shown long-term benefits in outcomes for infants with moderate to severe HIE who were treated with therapeutic hypothermia.
        - Decrease in death
        - Decrease in neurodevelopmental deficits: cerebral palsy, motor and developmental delays
- Overview of therapy and what to expect:
    - Consultation with center that offers therapeutic hypothermia
    - Hypothermic protocol should be initiated within 6 hours of birth.
    - Infants are cooled to 33.5 °C and maintained within hypothermic range for 72 hours.
    - Gradual rewarming (rate of 0.5 °C/hr) starts at 72 hours.

Standardized Approach to Evaluation and Treatment

- Inclusion criteria
- Sarnat Scoring Tool

Outpatient Follow-up

- Multi-disciplinary follow-up to include assessment of developmental milestones, hearing, and vision is indicated
- Developmental assessments in infants can start as early as 4 months of age

References

Bonifacio SL, Hutson S. The Term Newborn: Evaluation for Hypoxic-Ischemic Encephalopathy. *Clin Perinatol*. 2021 Aug;48(3):681-695. doi: 10.1016/j.clp.2021.05.014. PMID: 34353587.

Committee on Fetus and Newborn; Papile LA, Baley JE, Benitz W, Cummings J, Carlo WA, Eichenwald E, Kumar P, Polin RA, Tan RC, Wang KS. Hypothermia and neonatal encephalopathy. *Pediatrics*. 2014 Jun;133(6):1146-50. doi: 10.1542/peds.2014-0899. PMID: 24864176.

Recommended Guidelines for
Screening and Treatment of Neonatal Encephalopathy
Requiring Therapeutic Hypothermia

Birthing Hospital Screening Criteria

Because the window for treatment for hypoxic ischemic encephalopathy is short (6 hours), any infant equal to or greater than 35 weeks gestation with a history of an acute perinatal event with the potential for hypoxia accompanied by any one of the following should be immediately referred to a neonatal intensive care unit that provides therapeutic hypothermia:

- APGAR less than or equal to 5 at 10 minutes of life
- Assisted ventilation required at 10 minutes of life

Infants regardless of perinatal history with an umbilical cord or central blood gas obtained within 1 hour of life with one of the following should be immediately referred to a neonatal intensive care unit that provides therapeutic hypothermia:

- pH of 7 or less
- Base Deficit of negative 16 mEq or greater

Infants with severe IUGR, severe chromosomal or congenital anomalies or who are unlikely to benefit from or respond to aggressive life support are not eligible for therapeutic hypothermia.

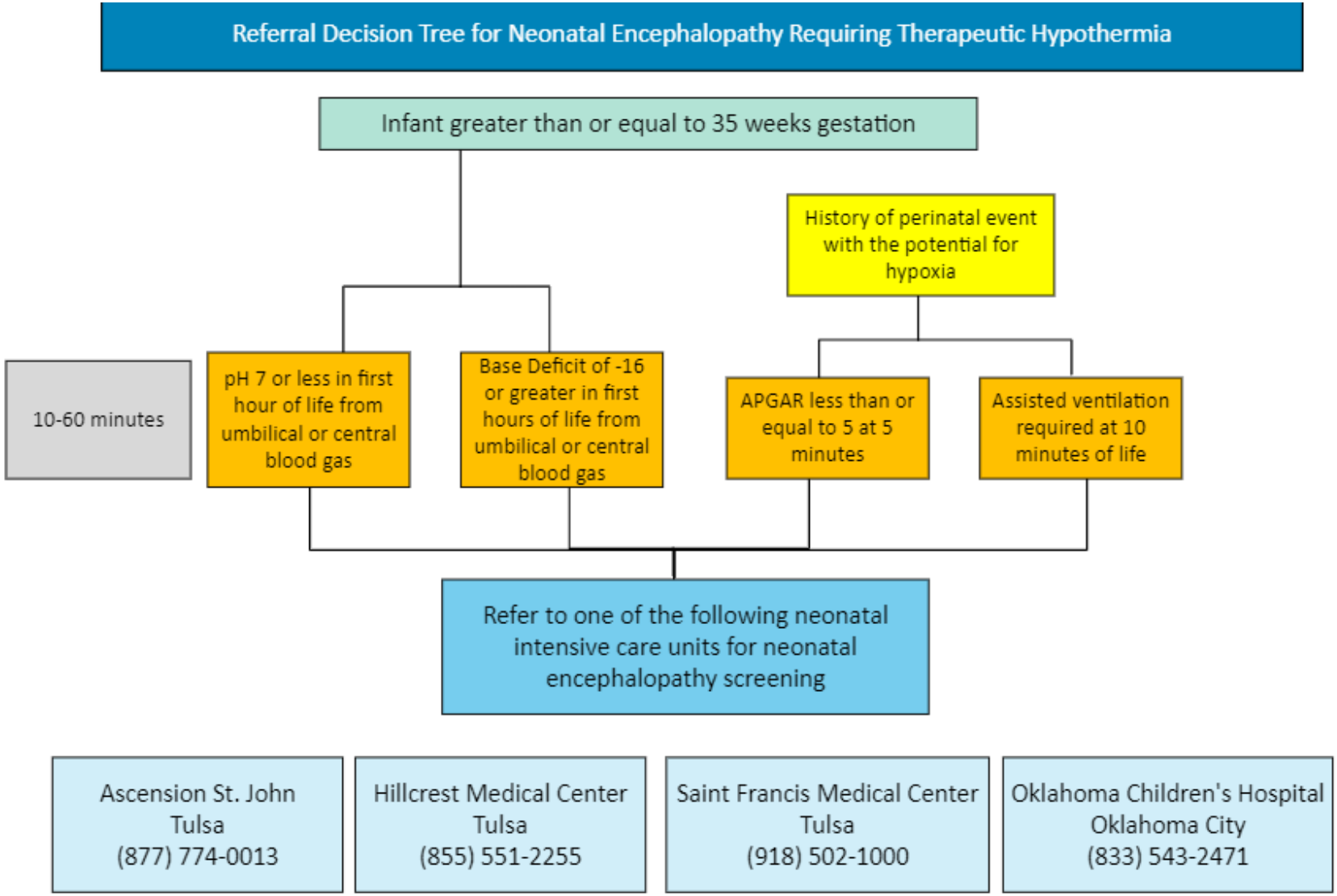
Neonatal Intensive Care Unit Confirming Criteria

The presence of seizure activity or presence of moderate to severe neonatal encephalopathy qualifies the infant for treatment with therapeutic hypothermia.

In the absence of seizure activity, a Neonatologist, or a clinician under the supervision of a neonatologist should examine the infant for signs of encephalopathy using the Modified Sarnat Scoring Tool. The presence of abnormal neurologic signs affecting 3 of the 6 categories on the modified Sarnat examination indicates moderate to severe encephalopathy and the infant should receive treatment with therapeutic hypothermia. Passive cooling is directed by the neonatal intensive care unit that provides therapeutic hypothermia and should begin as soon as all criteria are met. Passive or active cooling should continue during transport to the neonatal intensive care unit that provides therapeutic hypothermia.

If the infant is not having seizure activity or the neurological exam using the Modified Sarnat Scoring Tool does not indicate moderate to severe encephalopathy, the infant should be kept normothermic and transferred to a neonatal intensive care unit that provides therapeutic hypothermia for continued observation. The Modified Sarnat Scoring Tool is repeated hourly until the scoring tool indicates moderate to severe encephalopathy or the infant reaches 6-hours post birth.

Use of therapeutic hypothermia outside of the 6-hour window or for infants who do not meet screening and confirming criteria requires parental consent.


Referral Decision Tree for Neonatal Encephalopathy Requiring Therapeutic Hypothermia
Infant greater than or equal to 35 weeks gestation
History of perinatal event with the potential for hypoxia
10-60 minutes
pH 7 or less in first hour of life from umbilical or central blood gas
Base Deficit of -16 or greater in first hours of life from umbilical or central blood gas
APGAR less than or equal to 5 at 5 minutes
Assisted ventilation required at 10 minutes of life
Refer to one of the following neonatal intensive care units for neonatal encephalopathy screening
Ascension St. John
Tulsa
(877) 774-0013
Hillcrest Medical Center
Tulsa
(855) 551-2255
Saint Francis Medical Center
Tulsa
(918) 502-1000
Oklahoma Children's Hospital
Oklahoma City
(833) 543-2471

Passive Cooling Directions

CAUTION: Passive cooling should ONLY be initiated under the direction of a neonatologist/clinician from a NICU providing therapeutic hypothermia.

Modest hypothermia (core temperature of 33 to 35 degrees C [91.4 to 95 degrees F]) may be indicated for some infants with moderate to severe hypoxic ischemic encephalopathy. Passive cooling may be advantageous for some infants with signs of perinatal depression prior to and during transport when eligibility for hypothermia therapy is being considered. During passive cooling, no external sources of cooling are applied. Care must be taken to avoid over-cooling because passive cooling is unregulated and, depending on patient-specific and environmental circumstances, the infant's temperature may fall too low.

Directions:

1. Determine the infant's initial axillary temperature. Do not turn on any external heat source if axillary temperature is above 34.5 °C (94.1 °F). Remove blankets. Assess and document axillary temperature every 15 minutes to maintain temperature at 34.5 °C (91.4 °F).

2. If temperature falls below 34 °C (93.2 °F), place the infant on a radiant warmer on servo control initially at 35 °C (95 °F). Gradually decrease or increase set point by 0.5 °C (0.9 °F) every 30 minutes to maintain axillary temperature at 34.5 °C (91.4 °F).

3. Keep cardiorespiratory monitor and pulse oximeter on at all times as infant may be bradycardic with cooling. Report bradycardia less than 90 bpm.

4. Assess pulses, color, perfusion, extremity temperature every 30 minutes and as needed. Report diminished pulses, prolonged capillary refill, central cyanosis, and increasing pallor.

5. Assess for signs of respiratory distress and apnea.

6. Assess for seizure activity.

7. Check blood glucose hourly until it stabilizes. Blood glucose may be higher than usual when metabolic rate is decreased secondary to cooling. Report blood glucose less than 40 or greater than 150 mg/dL.

SARNAT SCORING TOOL

Sarnat Level		
Category	**Moderate**	**Severe**
Level of consciousness	Lethargic	Stupor/coma
Spontaneous activity	Decreased activity	No activity
Posture	Distal flexion, full extension	Decerebrate
Tone	Hypotonia (focal, general)	Flaccid
Primitive reflexes: Suck Moro	 Weak Incomplete	 Absent Absent
Autonomic system: Pupils Heart rate Respirations	 Constricted Bradycardia Periodic breathing	 Skewed deviation/dilated/nonreactive Variable heart rate Apnea

Therapeutic Hypothermia (Cooling)

What is cooling?

- Cooling is a treatment for suspected hypoxic ischemic encephalopathy (HIE). Within 6 hours of birth, your baby's temperature is cooled below normal body temperature and is kept in this low range of 33°C to 34°C (91.4°F to 93.2°F) for 72 hours. Cooling may stop further injury to your baby's brain and may reduce or prevent physical or mental conditions that limit movement, senses and activities.

What to expect/side effects

- Sleepy/sedated
- Pale, patchy, slightly blue skin coloring
- Possible shivering
- Slowing of the heart rate (will return to normal rate after cooling)
- Monitors to track heart rate, oxygen levels and breathing, lines into the umbilical cord, tubes in the mouth
- Medication administration - While the cooling process has not been shown to cause pain, measures to comfort your baby, including pain medication, may be provided

What can I do?

- Allow your baby to rest
- Gently whisper to your baby
- Provide a calm and quiet environment
- Ask the health care team when hands-on time will occur
- Pump and store your breast milk
- Ask questions when you have them

Feel free to reach out to your baby's health care team

For more information about HIE, visit the www.hopeforhie.org