CookChildren's

Clinical pathway for the treatment of moderate/severe hypoxic ischemic encephalopathy

Infants ≥ 35 weeks admitted to the Neonatal Intensive Care Unit (NICU) with an admitting diagnosis of neonatal depression, acute perinatal asphyxia or encephalopathy will be evaluated in two steps; evaluation by clinical and biochemical criteria **(step A)**, followed by neurological exam **(step B)**.

Step A

All infants will be evaluated if any of these findings are part of their history:

1. History of an acute perinatal event (abruption placenta, cord prolapse, severe fatal heart rate (FHR) abnormality: variable or late decelerations)
2. An Apgar ≤ 5 at 10 minutes
3. Cord pH or any postnatal blood gas pH at ≤1 hour of ≤7.0
4. Base deficit on cord gas or any postnatal blood gas at ≤ 1 hour of ≥16 mEq/L
5. Continued need for ventilation initiated at birth and continued for at least 10 minutes

If blood gas is available:	**If blood gas is not available, or pH 7.01 to 7.15, or base deficit 10 to 15 mEq/L**
A1 • Cord pH or any postnatal blood gas pH ≤ 7.0 **or** • Base deficit on cord pH or any postnatal blood gas at ≥ 16 mEq/L	**A2** • Acute perinatal event **and** • An Apgar score ≤ 5 at 10 minutes **or** • Continued need for ventilation initiated at birth and continued for at least 10 minutes
Once infant meets either A1 or A2, proceed to neurologic examination **(Step B)**.	

Step B

The presence of moderate/severe encephalopathy defined as seizures or presence of one or more signs in three of the six categories (level of consciousness, spontaneous activity, posture, tone, primitive reflexes and autonomic system). Please document specific findings in the medical record that led to the category of encephalopathy – even if the infant did not meet cooling criteria.

When findings are mixed, the extent of encephalopathy is determined by which category describes the majority of signs. If signs were equally distributed, categorize level of encephalopathy based on the level of consciousness.

Physical exam matrix for Sarnat Scoring of encephalopathy level (step B)

Category	Normal	Mild encephalopathy	Moderate encephalopathy	Severe encephalopathy
1. Level of consciousness	When awake, alert, fixes on visual stimulation	Irritable, hyper alert, poor feeding, excess crying alternating with sleeping	Lethargic	Stupor/coma
2. Spontaneous activity	Frequent spontaneous movements	Increased, jittery	Decreased	No activity
3. Posture	Extremities flexed in toward the trunk	Slight flexion, slight extension	Distal flexion, full extension	Decerebrate
4. Tone	Normal	Normal or slightly increased	Hypotonia (focal, general)	Flaccid
5. Primitive reflexes: suck, Moro	Strong coordinated suck, complete Moro	Uncoordinated, exaggerated Moro	Weak, incomplete	Absent suck, absent Moro
6. Autonomic system pupils	Reactive	Dilated	Constricted	Skew deviation/dilated/ non-reactive to light
7. Heart rate Respirations	Normal	Tachycardia	Bradycardia periodic/ breathing	Variable heart rate (HR) apnea

Exclusion criteria: inability to be evaluated by 6 hours of age

The neurologic examination will be performed by an experienced examiner. If the infant meets criteria A1 or A2 and criteria B and does **not** meet exclusion criteria, the infant is eligible for therapeutic whole body cooling. Consult Pediatric Neurologist for evaluation.

- Avoid hyperthermia at referral hospital and on transport
- Active cooling to be done on transport per Teddy Bear Transport guidelines

Safety monitoring and clinical considerations for infants:

- Avoid hyperoxemia and hypocarbia
- Pre and post ductal Sp02 will be continuously monitored
- Metabolic status: AST, ALT, alkaline phosphatase, lactic acid, iCa, serum electrolytes, BUN and creatinine will be monitored at least once at 24 hours of life
- Respiratory status: blood gases will be monitored at initiation and as appropriate
- Hematologic: if spontaneous bleeding or infant with severe encephalopathy consider monitoring for coagulopathy

Imaging studies:

A cranial ultrasound should be obtained within 12 hours of therapy if infant has clinical coagulopathy or focal neurologic exam. MRI exam should occur on day 4-5. Earlier MRI may be considered to make decisions about offering withdrawal of intensive care to families in severe cases.

Pain/sedation management:

- Pain stress may have adverse effects on infants with HIE
- Low dose morphine or dexmedetomidine drip should be used, even if non-intubated patients
- "Normal" heart rate may reflect stress or hypovolemia

Seizure management:

- Continuous EEG monitoring in first 24 hours and on third day of life leading up to and including rewarming
- First line drug is phenobarbital. If refractory seizures after phenobarbital, consider fosphenytoin with neurology service input.

Persistent shock:

- Consider echocardiogram to evaluate for cardiogenic shock/PPHN
- Consider cortisol level as infant may have adrenal insufficiency