

Hypothermia in Neonates with HIE



A NURSING PERSPECTIVE
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Objectives



- Florida Neonatal Neurologic Network
- What is HIE?
- Criteria for cooling therapy
- Modified Sarnat exam
- Typical order sets
- Special considerations for the HIE infant
- Hands on education to demonstrate cooling/HIE equipment

What is The Florida Neonatal Neurologic Network (FN³) ?



- Founded by Dr. Michael Weiss and Dr. Craig Sussman in 2011 at the University of Florida Shands Children's Hospital to standardize hypothermia treatment for HIE.
- The Florida Neonatal Neurologic Network's (FN³) mission is to provide state-of-the-art care for **newborn babies with brain injuries** and to collect research and develop future therapies to **improve long-term outcomes**.
- Learn more at www.hopefn3.org

The Florida Neonatal Neurologic Network



FN³ Sites:

- UF Health at Shands
- UF Health Jacksonville
- Wolfson Children's Hospital
- Winnie Palmer
- Florida Hospital for Children
- Tampa General
- St. Joseph's Women's Hospital
- Sacred Heart
- Tallahassee Memorial
- Nemours
- Gulf Coast Regional Medical Center

What is HIE?



Hypoxic-Ischemic Encephalopathy:

Hypoxic-Ischemic Encephalopathy (or HIE) is a non-specific term for brain dysfunction caused by a lack of blood flow and oxygen to the brain.

Criteria for Hypothermia Treatment



Patients with presumed HIE must meet ALL of the following to be eligible for hypothermia treatment:

Age, Size, and Time



- Gestational age greater than or equal to 35 weeks
- Birth weight greater than or equal to 1.8kg
- Less than or equal to 6 hours since insult occurred

Blood Gas



One or more of the following predictors of severe HIE:

- pH less than or equal to 7.0 with base deficit of greater than or equal to 16 on arterial blood gas determination (base excess more than -16)
- pH 7.01-7.15, base deficit 10-15.9 or no blood gas available and acute perinatal event (cord prolapse, heart rate decelerations, uterine rupture) and either APGAR less than or equal to 5 at 10 mins or assisted ventilation at birth required for greater than or equal to 10 mins

Seizures *OR* any 3 of the 6 abnormal findings



| Clinical Criteria | Signs of Encephalopathy | |
|----------------------------------|--|---|
| | Moderate Encephalopathy | Severe Encephalopathy |
| 1. Level of consciousness | Lethargic | Stupor/coma |
| 2. Spontaneous activity | Decreased activity | No activity |
| 3. Posture | Distal flexion, complete extension, frog leg posture | Decerebrate |
| 4. Tone | Hypotonia (focal or general), hypertonia (focal or truncal). | Flaccid |
| 5. Primitive reflexes | | |
| Suck | Weak or bite | Absent |
| Moro | Incomplete | Absent |
| 6. Autonomic system | | |
| Pupils | Constricted | Skew deviation /dilated/non-reactive to light |
| Heart rate | Bradycardia | Variable |
| Respirations | Periodic | Apnea or intubated |

Exclusion Criteria



- Presence of lethal chromosomal abnormalities
- Severe IUGR
- Significant intracranial hemorrhage with a large intracranial hemorrhage (Grade III or IV)
- **Note:** *may start hypothermia without obtaining HUS if not immediately available, but should be obtained as soon as possible after start of hypothermia*

Modified Sarnat Exam



- Tool used to determine degree of HIE

Sarnat score of 2 = moderate HIE

Sarnat score of 3 = severe HIE

Easy! Score determined by which column has the most checks

- Done by neonatologist at birth/admission and every 24 hours
- Final Sarnat Exam done when infant is warmed

Moderate = 2 Severe = 3



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HIE Orders.....



Don't be scared, be prepared!

HIE Orders



- **Consult HIE team** – this is important not only to obtain consent, but also due to the complexity of this patient population
- **NPO** or consider low volume feeds (trophic) depending on the clinical condition of the neonate
- **VS** Q15 X4, then Q30 X2 then Q1^o
- Record **strict I&O**
- Place **Foley catheter** if urinary output is low, may remove if urine output is deemed adequate - if anuria, may need to replace foley
- Place neonate on servo-controlled **cooling device** (Blanketrol® III or Criticool®)
- Place indwelling rectal or esophageal **temperature probe** – rectal probe at Shands
- Adjust set temperature to maintain rectal or esophageal temperature in the range of 33.0 to 34.0°C with a target of **33.5°C** using servo-controlled cooling blanket. Notify MD or NNP if temperature falls outside this range
- Record rectal or esophageal **temperatures q hour**

HIE Orders (cont..)



- Move infant's position on the blanket q hour to avoid skin injury – very important and why infant is frequently a 1:1 nursing assignment
- Set lower heart rate limit at 70

Educational Guideline: Cooled babies at temperatures of 33-34°C have mild bradycardia of around 100 bpm. A heart rate consistently above 110 bpm in cooled infants with temperatures of 33-34°C suggests that the infant is distressed or may have volume loss. The bedside clinician may consider increasing the sedation if appropriate. Conversely, a heart rate below 70 may lead to decreased cardiac output. The clinician may consider increasing the temperature set point by 0.3°C increments to a maximum of 35°C

- Start a continuous opiate infusion at a low dose or intermittent dosing (Fentanyl at SHANDS)

HIE Orders (cont.)



Ordered Tests

- Obtain **Cranial ultrasound** with Doppler flow to measure resistive index as soon as possible – may need to call EEG to remove leads to allow for HUS

(Ordered to rule out other causes of encephalopathy and as an indicator of severity of hypoxic-ischemic injury)

- Place cerebral function monitor (aEEG) on patient or obtain continuous video **EEG** monitoring. Monitor for 72 hours and during rewarming.
- Consider **echocardiogram** due to neonates with HIE having cardiac dysfunction often with the need for pressor support and the association of HIE with pulmonary hypertension
- Consider **renal ultrasound** with Doppler flow if the patient has anuria or severe oliguria

HIE Orders (cont)



LABS

- Arterial blood gases with lactate q 6 hours
- Electrolyte panel with ionized calcium, magnesium, and phosphorus now and q 12 hours while undergoing hypothermia therapy
- CBC with differential and platelets now and q 12 hours
- PT, INR, PTT, Fibrinogen, D-Dimer now and q 12 hours while undergoing hypothermia therapy

Consider therapy to maintain PT less than 19, Fibrinogen greater than 100, platelets greater than 50,000 as HIE is associated with increased risk of coagulopathy or bleeding

If coagulation profile is abnormal requiring correction, follow-up in 6 hours after treatment. If normal x 2 without replacement, discontinue coagulation profile monitoring

- Urine dipstick for blood, q 24 hours while undergoing hypothermia therapy
- Liver function test (LFTs) now and at 24 hours.
- Accu checks- Q1^o until 3 consecutive results that are appropriate, then Q2^o for 4h then Q4^o for 24h then Q8^o for 24h.

HIE Orders (cont.)



Re-Warming:

- **Electrolyte panel** with ionized calcium, magnesium, and phosphorus prior to re-warming

*Call with results prior to re-warming and **do not re-warm until electrolyte abnormalities are resolved** as these may worsen during the re-warming process*

- Check **vital signs**, make sure HR < 160 and BP mean > or = 35 (Call if abnormal)
- **Re-warm infant** by increasing the set temperature on the servo controlled cooling blanket **by 0.3 °C every hour** until patient temperature is 36.5 degrees C, then discontinue cooling blanket
- VS q 1 hour during re-warming

*If infant begins to have seizures during the re-warming process, **STOP re-warming and maintain infant at current temperature until seizures are under control***

HIE Orders (cont.)



Re-Warming Guidelines (cont.)

- After re-warming is completed, manage radiant warmer per nursery protocol
- Diffusion Weighted **MRI** with spectroscopy at 4-5 days of life and again at 7-12 days of life. (Most accurate MRI reading is obtained immediately after warming, however not always a possibility)
- If only one MRI can be obtained, it should occur at 7-12 days of life.

(Educational Guideline: Diffusion Weighted MRI (performed with all studies) and Spectroscopy (needs to be ordered separately) are adjuncts in determining prognosis)

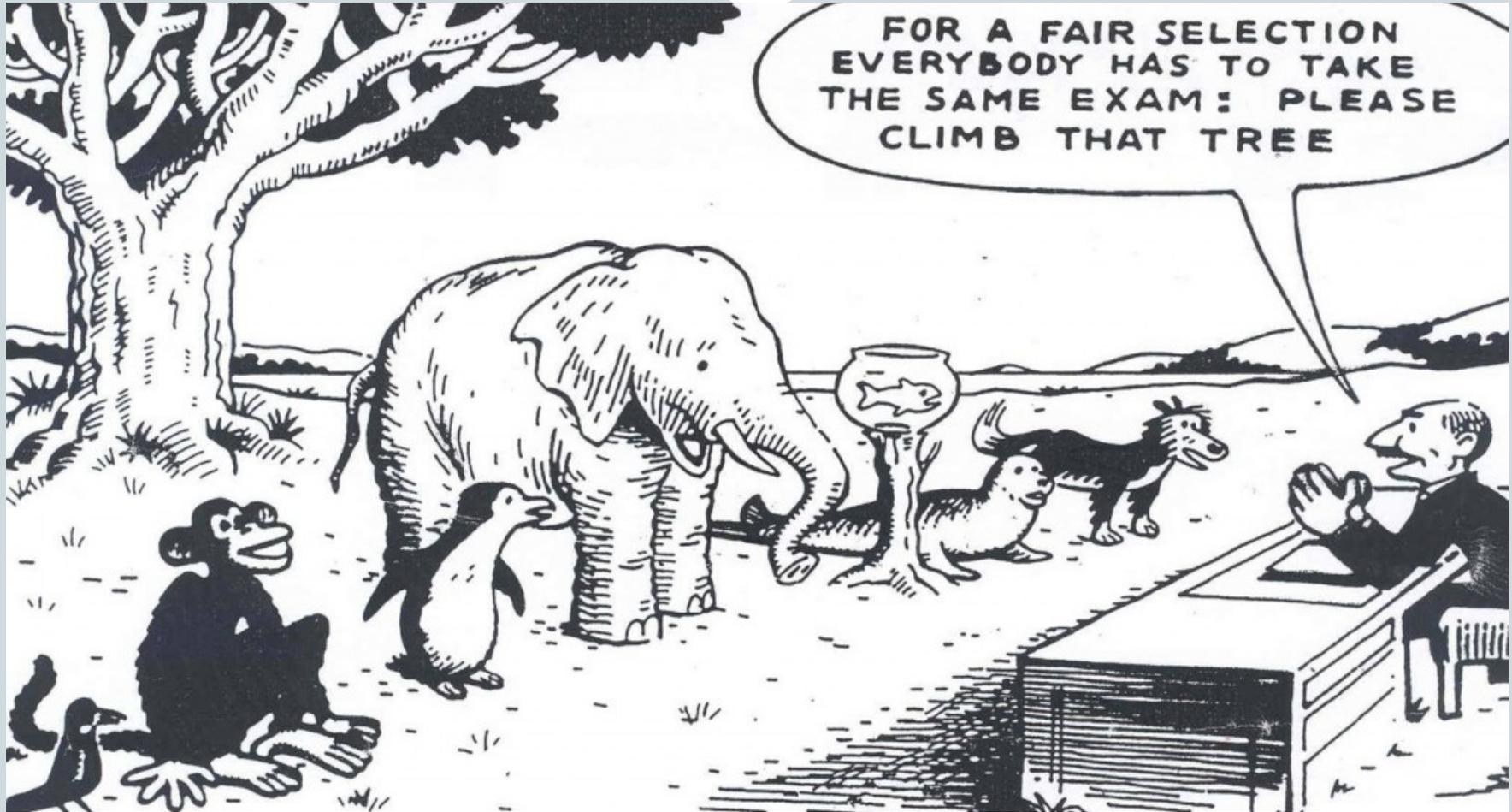
HIE Orders (cont.)



Twenty-four (24) Hours after re-warming

- PT, Fibrinogen, D-Dimer
- Urine dipstick for blood
- CBC with differential and platelets
- Electrolyte panel with ionized calcium, magnesium, and phosphorus
- Follow-up studies
- *Refer to **Early Steps** Program for OT and/or PT – Early intervention is imperative for the best possible, long term outcomes!*

Assessment of HIE Infant



Respiratory



- The respiratory status of HIE infants will vary (Room air to intubation to ECMO) – regardless of required support ABG's are obtained q 6 hrs.
- Important to not over ventilate - HIE patients are prone to Hypocapnia due to low metabolism and reduced CO₂ production from hypothermia. *
 - Hypocapnia leads to decreased cerebral perfusion and decreased release of hemoglobin. Also, linked to death and poor neurodevelopmental outcomes*
- Wean the Oxygen as tolerated - Hyperoxia leads to increased oxidative stress and increased free radical production.
 - It can be especially toxic in the setting of reperfusion and attenuate brain injury.
 - Further, hyperoxia has been associated with death and poor long-term outcomes post asphyxia.

Cardiovascular



- Evaluate cardiac enzymes for myocardial injury (CK, CK-MB, Troponin T)
- Echocardiogram should be obtained for all infants with HIE and repeated if cardiac enzymes are elevated, for clinical evidence of cardiac dysfunction or pulmonary hypertension, hypotension (MAP < 40) or for required inotropic support
- Relative bradycardia (**70-100 bpm**) is not an uncommon occurrence in infants undergoing hypothermia.
 - However, pathologic bradycardia can be a result of cardiac dysfunction, arrhythmias, deep hypothermia and increased intracranial pressure.
 - Clinical intervention should be initiated when bradycardia is associated with evidence of decreased cardiac output, electrolyte abnormalities, elevated cardiac enzymes, and/or ECG abnormalities.

Neurologic



- When doing neuro assessment, take into consideration that infant is sedated with Fentanyl or other opiate
 - Can use The Sarnat as a guide for Neuro assessment
 - Continuous aEEG or video EEG is highly recommended during hypothermia treatment for HIE
 - Seizures should be treated aggressively and monitored closely (over 50% of seizures from HIE will require more than one medication for treatment)
- *Baby may look better initially after birth, but seizures may begin at 12-24 hours of life – **IMPORTANT to document seizure activity and duration***
- MRI done after warming (see specifics under re-warming orders)

References



<http://hopefn3.org/protocols-and-guidelines/>