NCCU CLINICAL GUIDELINES

SECTION: 15

NEUROLOGY

Section: 15 Neurology
Hypoxic ischaemic encepalopathy
Date issued: July 2006
Date revised: Sept 2014
Review date: Sept 2017

Neonatology Clinical Guidelines
King Edward Memorial/Princess Margaret Hospitals
Perth Western Australia
Authorisation & review by
Neonatal Coordinating Group

HYPOXIC ISCHAEMIC ENCEPHALOPATHY

DEFINITION

Lack of sufficient oxygen to the brain and a diminished amount of blood perfusing the brain, resulting in suppression of electrical activity and cortical depression.

EPIDEMIOLOGY

Intrapartum hypoxia affects 1-2 infants per 1000 live term births. Moderate to severe encephalopathy affects 0.5 -1 per 1000 live births. 20% are due to antenatal events, 35% due to intrapartum events, 35% due to antenatal & intrapartum events, and 10% postnatal (higher in preterm babies). However, neonatal encephalopathy can be present without evidence of hypoxia or ischaemia at birth.

PATHOPHYSIOLOGY

Following a hypoxic-ischaemic insult, neuronal death can occur in two ways:

- **Primary neuronal death** - immediate death if the insult is severe. This is related to cellular hypoxia leading to primary energy failure and cellular depolarisation.

- **Secondary phase -** after a latent period (at 6 -100 hours) neuronal death may be initiated by a cascade of pathologic processes and is associated with marked encephalopathy. This involves cytotoxic oedema, mitochondrial failure, accumulation of excitotoxins, active cell death, nitric oxide synthesis and cytotoxic actions of activated microglia. Seizure activity is increased during this phase.

CLINICAL PRESENTATION

There may be evidence of other end-organ damage such as coagulopathy, raised liver enzymes, acute renal failure, hypotension, persistent fetal circulation and/or respiratory failure.

INVESTIGATIONS

- Neurological examination.
- Blood tests to exclude other organ function - Blood gases, FBC, coagulation profile, liver enzymes, urea and creatinine, glucose, electrolytes (including Ca, Mg, and PO_4), lactate.
- Brainz monitor / EEG if seizures are evident.
- Lumbar puncture if sepsis suspected
- Head Ultrasound ± CT scan or MRI.

Variable	Stage I	Stage II	Stage III
Level of consciousness	**Alert**	**Lethargic**	**Comatose**
Muscle tone	**Normal or hypertonic**	**Hypotonic**	**Flaccid**
Tendon reflexes	**Increased**	**Increased**	**Depressed or absent**
Myoclonus	**Present**	**Present**	**Absent**
Seizures	**Absent**	**Frequent**	**Frequent**
Complex reflexes **Suck** **Moro** **Grasp** **Oculocephalic (doll eye)**	 **Active** **Exaggerated** **Normal to exaggerated** **Normal**	 **Weak** **Incomplete** **Exaggerated** **Overactive**	 **Absent** **Absent** **Absent** **Reduced or absent**
Autonomic function **Pupils** **Respiration** **Heart rate**	 **Dilated, reactive** **Regular** **Normal or tachycardia**	 **Small, reactive** **Periodic** **Bradycardia**	 **Variable/fixed** **Ataxic, apneic** **Bradycardia**
EEG	**Normal**	**Low voltage,periodic, or paroxysmal**	**Periodic or isoelectric**

PROGNOSIS

- Mild (stage I): all survive and are normal.
- Moderate (stage II): 5% die, 20% with neurological sequelae.
- Severe (stage III): 75% die, 90 -100% with neurological sequelae.

MANAGEMENT

This is dependent on the extent of organ failure.

1. TEMPERATURE CONTROL.

Evidence from high quality RCTs indicates that cooling of neonates with moderate to severe HIE is safe and reduces the risk of death or disability at 18 to 22 months of age.

Therefore, cooling is the first intervention which has been proven in rigorously conducted scientific studies to be beneficial in term & near term neonates with HIE.

Please see guideline on Systemic Cooling for Neuroprotection in Neonates ≥35 weeks gestational age with Hypoxic Ischaemic Encephalopathy (HIE)

2. AVOID HYPOGLYCAEMIA

The blood sugar is often transiently elevated immediately after asphyxia, often followed by hypoglycaemia.

To prevent secondary hypoglycaemia

- Provide 6-8mg/kg/min of glucose infusion IV and Check PGLs hourly for the first 4 hours.
- Increase concentration of dextrose to maintain above Glucose Infusion Rate, if fluid restriction required.
- If PGLs maintained well above 2.6 mmmol/L frequency of checking may be reduced, but should remain at least 4 hourly for the first 24hours. (see hypoglycaemia guideline.)

3. APPROPRIATE MANAGEMENT OF ASSOCIATED PROBLEMS

Sepsis (see infection section).

4. FLUID RESTRICTION

40 – 50ml/Kg/day.

5. RESPIRATORY SUPPORT

May be needed for poor self ventilation, seizures, etc.

6. BLOOD PRESSURE SUPPORT

Volume expansion or Inotrope may be required. The infant should remain normotensive to maintain cerebral perfusion pressure but not too high to prevent reperfusion injury.

7. SEIZURE CONTROL (SEE SEIZURES)

8. FOLLOW-UP

All infants showing signs of HIE require appropriate follow-up.

REFERENCES

- Booth D, Evans DJ. Anticonvulsants for neonates with seizures. *The Cochrane Database of Systematic Reviews* 2004, Issue 3.
- Edwards AD and Azzopardi DV (2006). Therapeutic hypothermia following perinatal asphyxia. *Archives of Disease in Childhood - Fetal and Neonatal Edition* 2006;**91**:F127-F131
- Evans DJ, Levene MI. Anticonvulsants for preventing mortality and morbidity in full term newborns with perinatal asphyxia. *The Cochrane Database of Systematic Reviews* 2001, Issue 2.
- Higgins R, Raju T, Edwards AD, Azzopardi D et al. Hypothermia and Other Treatment Options for Neonatal Encephalopathy: An Executive Summary of the Eunice Kennedy Shriver NICHD Workshop. The Journal of Pediatrics. www.jpeds.com, Vol. 159, No. 5, 851-858.
- Jacobs S, Hunt R, Tarnow-Mordi W, Inder T, Davis P. Cooling for newborns with hypoxic ischaemic encephalopathy. *The Cochrane Database of Systematic Reviews* 2003, Issue 4.
- Kecskes Z, Healy G, Jensen A. Fluid restriction for term infants with hypoxic-ischaemic encephalopathy following perinatal asphyxia. *The Cochrane Database of Systematic Reviews* 2005, Issue 3.
- Merchant N, Azzopardi D. Hypoxic-ischaemic encephalopathy in newborn infants. Fetal and Maternal Medicine Review 2010; **21**:3 242–262. Cambridge University Press 2010, doi:10.1017/S0965539510000069