



CLINICAL PRACTICE GUIDELINE  
NEWBORN EMERGENCY TRANSPORT SERVICE (NETS WA)

# Hypoxic Ischaemic Encephalopathy (HIE) / Asphyxia

This document should be read in conjunction with the [Disclaimer](#)

Brain injury following ischaemia and reperfusion insult can be understood as follows:

- Primary neuronal death (usually around birth).
- Latency period.
- Reperfusion injury (> 6 hours post injury). Seizure activity increased in this time.

Depending on the severity of brain injury, hypoxic ischaemic encephalopathy (HIE) may develop after birth. Significant HIE can result in multi-organ failure.

- Coagulopathy.
- Renal/ hepatic dysfunction.
- Hypotension.
- Respiratory failure.
- PPHN

## Clinical Staging of HIE

The presence of moderate/severe HIE is defined as seizures **OR** presence of signs in at least three of the six categories given below:

| Category               | Mild encephalopathy             | Moderate encephalopathy          | Severe encephalopathy      |
|------------------------|---------------------------------|----------------------------------|----------------------------|
| Level of consciousness | Alert                           | Lethargic                        | Stupor/coma                |
| Spontaneous activity   | Normal activity                 | Decreased activity               | No activity                |
| Posture                | Normal                          | Distal flexion<br>Full extension | Decerebrate                |
| Tone                   | Normal                          | Hypotension                      | Flaccid                    |
| Primitive reflexes     | Normal suck<br>Exaggerated moro | Weak suck<br>Incomplete moro     | Absent suck<br>Absent moro |
| Autonomic system:      |                                 |                                  |                            |
| Pupils                 | Dilated/reactive                | Constricted                      | Dilated/non-reactive       |
| Heart rate             | Tachycardia                     | Bradycardia                      | Variable heart rate        |
| Respirations           | Regular respiration             | Periodic breathing               | Apnoea                     |

## General Management

- Intubation and ventilation if having seizures with unsafe airway, recurrent apnoea or respiratory depression.
  - Beware not to over-ventilate (aim for  $\text{PaCO}_2 > 35$ ).
- UVC if difficult IV access; UAC desirable if requiring inotropes (and does not prolong transport significantly).
- Blood pressure support with volume (10-20 mL/kg normal saline boluses) or inotropes.
  - Dobutamine may be better, as myocardial contractility may be poor.
  - Beware over-judicious inotrope use (especially dopamine), as cerebral vasoconstriction may be detrimental.
  - Beware fluid overload, as may have compromised myocardium, and cerebral oedema.
- Avoid hypoglycaemia (aim for  $\text{BGL} > 3\text{mmol/L}$ ), correct other electrolyte disturbances.
- Fluid restrict to 40-50 mL/kg/day. However, **avoidance of hypoglycaemia is MORE important than fluid restriction**; consider increasing the concentration of glucose, or increase maintenance fluids to 60 ml/kg/day.
- IV antibiotics.
- Treat seizures (see Guidelines on [Seizures](#)).
- Consider **systemic cooling to 33-34°C**.

## Inclusion Criteria for Cooling

1.  $\geq 35$  weeks gestational age.
2.  $< 6$  hours post birth (commence as soon as possible, the earlier the better).
3. Evidence of asphyxia as defined by the presence of at least two of the following four criteria:
  - APGAR  $< 6$  at 10 minutes or continued need for resuscitation with positive pressure ventilation +/- chest compressions at 10 minutes.
  - Any acute perinatal event that may result in HIE (i.e. abruption placenta, cord prolapse, severe foetal HR abnormality etc.).
  - Cord pH  $< 7.0$  or base deficit of 12 or more.
  - If cord pH is not available, arterial pH  $< 7.0$  or BE  $> 12$  mmol/L within 60 minutes of birth (if able to do gas).
4. Clinically defined moderate or severe HIE as per Sarnat Staging (see [Table](#) above).

## Management of Systemic Cooling

### PASSIVE Cooling

This is often effective and should be tried first for 1 hour by turning the warmer off and keeping the baby undressed and leaving the nappy unfastened.

- Strictly 15 minutely per axilla temperature measurements.
- Facilities for full cardiopulmonary monitoring (ECG and  $\text{SaO}_2$ ) should be available.

## ACTIVE Cooling

- **ACTIVE** Cooling may be started before the arrival of the NETS team **after discussion with the NETS CONSULTANT** in centres where the NETS Team is more than 1 hour away.
- Rectal probe for measurement of core temperature; if no rectal probe available, do 15 minutely per axilla temperature measurements. For the Neocot - connect temperature probe to monitor (T2).
- ECG monitoring, oxygen saturation monitoring.
- Nurse baby undressed and leave nappy unfastened.
- **ACTIVE** cooling involves applying cold packs (in cotton bags) to the baby according to temperature algorithm (see [Table](#) below) and aiming to achieve target range within 1 hour. (**Never** use ice packs).
- Maintain axillary/rectal temperature at 33-34°C.
- **WATCH TEMPERATURE CLOSELY.** Babies can become severely hypothermic if left unchecked. If axillary temp drops to < 34°C, remove **all** cold packs and set radiant warmer on manual and gradually adjust heater output to maintain axillary temp at 33-34°C.
- Leave ventilation humidity at normal temperature.
- When the infant is ready for transfer, reduce the temperature of the Neocot, but avoid switching it off to allow air circulation, consider reducing temperature in aircraft/ambulance during summer/hot days.
- Advise/reassure parents Re: appearance, cool to touch, explain the procedure.

| Temperature algorithm | Number of cool packs to be applied for ACTIVE cooling | Areas to apply               |
|-----------------------|---|------------------------------|
| > 37.0                | 4   | Head, shoulders, neck, trunk |
| 36.1 - 37.0           | 3   | Shoulders, neck, trunk       |
| 35.1 - 36.0           | 2   | Shoulders, trunk             |
| 34.1 - 35.0           | 1   | Trunk                        |
| 33.0 - 34.0           | 0   | Nil                          |

**Caution: Watch temperature range more closely in infants treated with anticonvulsants or muscle relaxants as they may cool much quicker.**

Related WNHS policies, procedures and guidelines

[NETS WA Clinical Guidelines: Seizures](#)

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|---|--|-------------------|---------------------------------|
| Document owner:   | Neonatal Directorate Management Committee  |                   |                                 |
| Author / Reviewer:  | Neonatal Directorate Management Committee  |                   |                                 |
| Date first issued:  | August 2009  |                   |                                 |
| Last reviewed:  | 1 <sup>st</sup> July 2017  | Next review date: | 1 <sup>st</sup> July 2020       |
| Endorsed by:  | Neonatal Directorate Management Committee  | Date endorsed:    | 26 <sup>th</sup> September 2017 |
| Standards Applicable:   | NSQHS Standards: 1  Governance, 6  Clinical Handover, 9  Clinical Deterioration |                   |                                 |
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