



Hypoxic Ischaemic Encephalopathy (HIE) / Asphyxia

Scope (Staff):	Nursing and Medical Staff
Scope (Area):	NETS WA

Child Safe Organisation Statement of Commitment

CAHS commits to being a child safe organisation by applying the National Principles for Child Safe Organisations. This is a commitment to a strong culture supported by robust policies and procedures to reduce the likelihood of harm to children and young people.

This document should be read in conjunction with this [disclaimer](#)

Aim

To identify neonates with HIE and correctly administer 'Therapeutic Hypothermia' (TH) within a timely manner and arrange a safe transfer to a Tertiary NICU.

To manage co-existing multi-organ dysfunction.

Risk

Late identification of HIE. Overcooling of patient. Mismanage multi-organ dysfunction.

Background

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/ endocrine dysfunction.
- Cardiovascular dysfunction and Hypotension.
- Respiratory failure.

- Persistent Pulmonary Hypertension of the Newborn (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:

It is of critical importance to document a full neurological examination prior to Therapeutic Hypothermia and before any anti-seizure or sedating medication is administered.

Sarnat Staging			
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 Full extension	Decerebrate
Tone	Normal	Hypotonic	Flaccid
Primitive reflexes	Normal suck Exaggerated moro	Weak suck Incomplete moro	Absent suck 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. Gasping or periodic breathing is common in moderate to severe HIE and requires intubation and ventilation. Respiratory support in HIE aims to maintain a pH of over 7.25, and a normal to high PaCO₂ (37.5 to 52.5 mmHG). A sustained difference in pre and post-ductal saturation of >5-10 % could indicate Pulmonary Hypertension.
 - Beware not to over-ventilate (aim for PaCO₂ > 35).
- UVC and UAC are desirable if they do not prolong transport significantly.
- Blood pressure support with volume (10-20 mL/kg normal saline boluses) or inotropes.
- There is no consensus on the ideal target mean systolic, diastolic or pulse pressure during TH or on the best pharmacologic agents to maintain it. Dobutamine and adrenaline are commonly chosen demonstrating short term

haemodynamic improvements in BP. Vasopressor use warrants caution due to potential pulmonary and systemic vasoconstriction.

- Dobutamine may be better, as myocardial contractility may be poor.
- Beware over-judicious inotrope use (especially dopamine), as cerebral vasoconstriction may be detrimental.
- Beware of fluid overload, as infant may have compromised myocardium, and cerebral oedema.
- Avoid hypoglycaemia (aim for BGL > 3.5mmol/L), correct other electrolyte disturbances.
- Fluid restrict to 40-50 mL/kg/day. However, **avoidance of hypoglycaemia is MORE important**. Consider increasing the concentration of glucose, or increase maintenance fluids to 60 mL/kg/day.
- Electrolyte disturbance and SIADH are common in HIE and requires monitoring.
- Urinary catheterization may be necessary as morphine can cause urinary retention via anti-cholinergic effects.
- Blood cultures should be taken and broad spectrum IV antibiotics should be administered.
 - Consider anti-viral treatment with acyclovir if there is any concern of HSV.
- Analgesia is commonly required for patient comfort with shivering or for vigorous neonates to maintain thermoregulation.
- Regular pressure injury risk and skin assessment is important in view of the potential complications during TH such as subcutaneous fat necrosis, a benign condition characterized by inflammation and necrosis of subcutaneous fat and cold panniculitis which is an acute nodular, erythematous eruption.
- Persistent acidosis, hyperlactatemia, and refractory hypoglycemia may indicate an inborn error of metabolism causing the encephalopathy rather than HIE.
- Treat seizures (see NETS WA Guideline on [Seizures](#)).

Inclusion Criteria for Therapeutic Hypothermia (Cooling)

1. ≥ 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 (BD) of 12 or more.
 - If cord pH is not available, arterial pH < 7.0 or BD > 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 Therapeutic Hypothermia

PASSIVE Cooling

No active processes (such as fans or wet cloths) for cooling the infant should be undertaken, the infant should be allowed to cool down of their own accord.

This is termed Passive Cooling.

The goal is an axillary temperature between 33°C and 34°C. Passively cooling a infant should occur in an area that allows constant monitoring of the infant by clinical staff.

1. Position the infant on a radiant warmer with the warmer turned off.
 - a. Do not place the infant in an incubator.
2. Leave the infant naked. Do not dress, or use a hat, or use any form of wrap (plastic or cloth). Leave the nappy unfastened.
3. Full cardiopulmonary monitoring if preferred if available, or a SaO₂ monitor.
4. If the infant is ventilated or on CPAP, use normal humidifier settings (i.e. do NOT turn off humidification)
5. Record the time of commencement of passive cooling and record axilla temperature **every 15 minutes**. If axillary temp drops below 33.5°C, set radiant warmer on manual and gradually adjust heater output to maintain axillary temp in the range 33°C – 34°C.
6. All other documentation/care/treatment should be the same as in any infant waiting for transport by NETS.
7. Recommend repeating a blood gas and blood glucose as directed by NETS

ACTIVE Cooling

- Active cooling will be commenced by the NETS team on arrival.
 - Until then passive cooling is adequate with regular temperature monitoring as described above.
- 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 and 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.
 - Over cooling may result in anuria, arrhythmia, and increased pulmonary hypertension.
 - If axillary temperature 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, by explaining the procedure.
- Take placenta for histopathology

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 CAHS internal policies, procedures and guidelines
Neonatology Guidelines <ul style="list-style-type: none"> • Hypoxic Ischaemic Encephalopathy (HIE) and Therapeutic Hypothermia NETS WA Guidelines <ul style="list-style-type: none"> • Seizures

This document can be made available in alternative formats on request.

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