Yorkshire and Humber ODN
Pan Network Clinical Guideline

Management of Hypoxic Ischaemic Encephalopathy Including Total Body Cooling

Authors: Adapted from the NTNN and YNN guidelines
Date written: June 2015
Review date: June 2018

This clinical guideline has been developed to ensure appropriate evidence based standards of care throughout the Yorkshire and Humber Neonatal ODN. The appropriate use and interpretation of this guideline in providing clinical care remains the responsibility of the individual clinician. If there is any doubt discuss with a senior colleague.

Recommendations represent widely used evidence-based practice and high quality standards that all Neonatal Units across the Network should implement. However, alternative appropriate local guidelines may also exist.

Aim of Guideline

- To ensure that babies with suspected hypoxic ischaemic encephalopathy (HIE) are appropriately assessed and managed clinically.
- To ensure therapeutic hypothermia is considered and initiated appropriately
- Ensure that cooling is managed in a safe and timely manner
- To outline the care pathway for the care of infants with HIE

Cooling should be offered to all babies who achieve at least 1 criteria A and B. See full guideline for “special cases”

<table>
<thead>
<tr>
<th>Criteria A</th>
<th>Criteria B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infants ≥ 36/40 with at least one of</strong></td>
<td><strong>Seizures</strong></td>
</tr>
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<tr>
<td>• pH&lt;7.00 within 60 mins of birth (umb/ arterial/ capillary)</td>
<td><strong>AND</strong></td>
</tr>
<tr>
<td>• Base deficit ≥ 16 in umb/cap/venous/ art blood sample within 60 mins of birth</td>
<td>• Abnormal tone (focal/ generalised hypotonia / flaccid) response)</td>
</tr>
</tbody>
</table>
Confirm severity of encephalopathy with clinical examination and CFM before cooling if possible, but do not delay cooling for CFM

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2. Indications for cooling
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1 Summary of Management of HIE

AT DELIVERY
Adequate resuscitation
Take arterial and venous umbilical cord gases and document in baby's notes
If encephalopathy suspected and >36wks gestation, commence passive cooling by switching off the overhead warmer. Continue to monitor temperature if being passively cooled and avoid overcooling.

VENTILATION
Consider artificial ventilation to maintain oxygenation
Maintain PaO2 6-10 kPa, PaCO2 5-7 kPa
Morphine sedation is routinely considered in infants who are offered therapeutic hypothermia but may need to be discontinued in order to enable assessment of severity of encephalopathy. Avoid paralysis unless essential for effective ventilation.

CVS
Obtain central vascular access (UVC/UAC). Collect samples for FBC, U&Es, Ca, Mg, LFTs, group & save, cultures & clotting
If MAP <40mmHg consider the following:
  o 10ml/kg 0.9% Saline bolus
If BP remains low:
  5-10 μg/kg/min dopamine and/or 5-10 μg/kg/min dobutamine. These can be titrated up to a maximum 20 μg/kg/min.
Avoid bicarbonate and fluid boluses unless infant has signs of hypovolaemia (in which case consider blood product replacement).

CNS
Perform a neurological assessment on admission and repeat over first 24 hours
See section on Assessment of Encephalopathy

SEIZURES
1st line: Phenobarbitol 20mg/kg over 20 minutes. Further dose of 10 mg/kg can be used 40-60 minutes later.
Consult local guidance for further management of seizures

SEPSIS
Start antibiotics after taking cultures if clinically indicated. However if using gentamicin, do pre dose level and wait for result before giving second dose.

FLUIDS
Fluid restrict at 40ml/kg/day and monitor blood sugars. May need higher concentration of dextrose if hypoglycaemia is a problem.

PARENTS
Senior member of medical team should aim to speak to family as soon as possible to explain level of concerns mentioning risk of death & disability.
(See BLISS information leaflet Appendix 2)
COOLING

Check if fits criteria for cooling. Likely to incur most benefit if applied early (certainly less than 4-6 hours based on current evidence). Note neurological status can change during first few hours therefore reassessment is recommended as the baby may subsequently “meet” the cooling criteria.

If indicated passive cooling should be started as soon as possible (see section 5). Consider switching off resuscitaire heater during resuscitation and switch off the overhead or incubator heater on the unit. Insert rectal probe and commence continuous rectal temperature monitoring. Aim to keep temperature between 33 and 34°C if possible and avoid hyperthermia and severe hypothermia (<32°C). Document rectal temperatures every 30 minutes.

TRANSER

If it is considered that the baby may require transfer or advice is needed (e.g. not a cooling centre or needs tertiary intensive care + cooling) call Embrace as early as possible for discussion (08451472472)

2 Indications for cooling

Cooling (therapeutic hypothermia) is an effective therapy for the treatment of newborn encephalopathy. Active cooling should only be conducted in centres that regularly cool infants and have the appropriate equipment and monitoring. Passive cooling should be initiated as soon as possible after delivery and can occur in the hospital of birth, using these guidelines.

Cooling should be offered to all babies who achieve at least 1 criteria A and B

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</tr>
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<td></td>
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</tr>
</tbody>
</table>

Confirm severity of encephalopathy with clinical examination and CFM before cooling if possible, but do not delay cooling for CFM.
Do not start cooling if infant:

- Is likely to require surgery during first three days after birth
- Has other major congenital abnormalities indicative of poor long term outcome are present
- Is felt to be dying

Cooling should be started as soon as possible with an aim to achieve the therapeutic target temperature within 6 hours of birth. Passive cooling should be started as soon as possible. Consider switching off resuscitaire heater during resuscitation and switch off overhead or incubator heaters once on the neonatal unit. For some infants, the need for cooling may become clear after a few hours and therefore neurological status should be reassessed frequently, however initiating cooling beyond 12 hours of age is not to be recommended.

Confirm severity of encephalopathy with cerebral function monitoring before cooling if possible, but do not delay cooling for cerebral function monitoring. Normal initial cerebral function monitoring indicates a high probability of normal outcome. In this case cooling is unlikely to be beneficial, and if treatment has been commenced the neonatal consultant may consider discontinuing.

Special cases:

*Infants 34-35 weeks*
For infants 34-35 weeks that otherwise fit the criteria for therapeutic hypothermia, decisions need to be made on a case by case basis depending on the clinical history.

There is no evidence of any therapeutic benefit from cooling for these babies (due to lack of studies) however there are increasing reports of lack of harm, although these are observational studies. Recent reviews have suggested cooling these babies in some situations may be appropriate², ³, ⁴, ⁵. Any decision to cool these babies should be made by a Level 3 Neonatologist/transport team in conjunction with the parents.

Postnatal Ward Collapse
Again observational studies and case series’ have been reported for infants cooled after postnatal ward collapse. Data extrapolated from adult literature in addition to the current perinatal data gives a good theoretical basis for benefit for these infants however there have been no randomised controlled trials. These infants would be best discussed on a case by case basis with the tertiary neonatologist and transport team², ³, ⁴, ⁵. Of note, all these case series’ and reviews suggest significant intracranial haemorrhage should be a contraindication to therapeutic hypothermia in view of the potential impairment in coagulation that cooling may worsen.
3 Criteria for defining moderate and severe encephalopathy:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Moderate Encephalopathy</th>
<th>Severe Encephalopathy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of consciousness</td>
<td>Reduced response to stimulation</td>
<td>Absent response to stimulation</td>
</tr>
<tr>
<td>Spontaneous activity</td>
<td>Decreased activity</td>
<td>No activity</td>
</tr>
<tr>
<td>Posture</td>
<td>Distal flexion, complete extension</td>
<td>Decerebrate</td>
</tr>
<tr>
<td>Tone</td>
<td>Hypotonia (focal or general)</td>
<td>Flaccid</td>
</tr>
<tr>
<td>Suck</td>
<td>Weak</td>
<td>Absent</td>
</tr>
<tr>
<td>Moro</td>
<td>Incomplete</td>
<td>Absent</td>
</tr>
<tr>
<td>Pupils</td>
<td>Constricted</td>
<td>Constricted</td>
</tr>
<tr>
<td>Heart rate</td>
<td>Bradycardia</td>
<td>Variable</td>
</tr>
<tr>
<td>Respiration</td>
<td>Periodic breathing</td>
<td>Apnoea</td>
</tr>
</tbody>
</table>

3 Passive Cooling Guideline

- Stop active warming by turning off the heater:
- Monitor and measure the rectal temperature every 15 minutes
- Commence continuous skin temperature monitoring if able.
- Maintain the rectal temperature between 33.0 – 34.0°C by passive cooling only (heater off).
- Ensure a low reading thermometer is used.
- Turn the heater on if the rectal temperature is less than 33.5 °C and continue to closely monitor the rectal temperature.

Do not delay passive cooling to await the arrival of the transport/retrieval team.

Risks and Precautions

Ensure low reading thermometer is used to check axilla temperatures- some will have a lower limit with leads to false readings.

Do not allow the temperature to fall below 33°C

Active cooling with the use of a fan, or using cool bags of fluids can cause overcooling.

These methods should only be used with rectal monitoring.

Ice packs must not be used to reduce the infant’s temperature as they can result in severe hypothermia.
Further Supportive Care for infants with Hypoxic Ischaemic Encephalopathy

The main principle of the management of these infants is to maintain normal homeostasis. Good documentation is essential.

At delivery
Adequate resuscitation, as per the Newborn Life Support guidelines. Take arterial and venous umbilical cord gases and document in baby’s notes. If encephalopathy suspected, switch off overhead heater.

TARGET TEMPERATURE 33.0 - 34.0 °C

*Ice packs should not be used for cooling as these can result in severe hypothermia, active cooling (e.g. fan) should not be used unless rectal temperature is monitored.
**Postnatal collapses** - Consider other diagnoses, such as sepsis and metabolic disorders.

**Ongoing care**

**Ventilation**
- Consider artificial ventilation to maintain oxygenation.
- Maintain O2 6-10 kPa, CO2 5-7 kPa.
- Try to avoid iatrogenic hypocarbia. Some babies spontaneously hyperventilate and this cannot easily be prevented, but consider ventilation and sedation if extreme and persistent.
- Morphine may be used as sedation acutely, but may require to be discontinued later to allow adequate assessment of the baby’s neurological status, especially if considering withdrawal of intensive care.
- Avoid paralysis unless essential for effective ventilation.

**Cardiovascular system**
- Consider central vascular access both venous and arterial.
- Collect samples for FBC (including the nucleated red cell count) CRP, U&Es, Ca, Mg, LFTs, group & save, cultures & clotting.
- In term infants the mean pressure should be > 40mmHg (see blood pressure guidelines)
- If MAP <40mmHg consider the following:
  - 10mL/kg 0.9% Saline bolus
  - Further 0.9% saline bolus or blood product replacement only if evidence of hypovolemia e.g. Feto-maternal haemorrhage.
  - Only use bicarbonate boluses if prolonged acidosis is causing compromise - the acidosis is usually due to anaerobic metabolism during the hypoxic ischaemic insult and will usually correct without intervention
  - If BP remains low there may be depressed myocardial function and large volumes of colloid or crystalloid may be harmful causing worsening hypotension and increasing risk of cerebral oedema.
- Follow hypotension guideline and consider doing echo and ECG.

** Fluids & Metabolic**
- Start 10% dextrose at 40 mL/kg/day, but review carefully in the light of progress at least 3 times in the first 24 hours. Maintain normoglycaemia – increasing glucose concentration rather than volume will avoid fluid overload.
- Monitor and treat hypocalcaemia (due to transient hypoparathyroidism and sick cell syndrome) and hypomagnesaemia.
- Check the lactate soon after admission, but remember the acidosis is usually metabolic due to anaerobic metabolism and will usually correct without volume or bicarbonate.
- Check LFTs and consider full metabolic screen including cardiac and muscle isoenzymes.
- Monitor the urine output and have a low threshold for catheterisation.
- Test the urine for blood and protein.
- If urine output is poor treat as renal failure with fluid restriction, but remember that prolonged fluid restriction may exacerbate or even cause renal failure.
CNS & Seizures
- Use CFM early, if available, to establish severity of encephalopathy. It may also be used to monitor seizures.
- Perform a neurological examination and document the clinical stage of encephalopathy.
- Consider requesting a formal EEG.
- For seizures; Phenobarbitol 20mg/kg over 20 minutes as first line, a further 10mg/kg and then follow local seizure guideline.
- Opisthotonic and tonic generalised seizures after profound asphyxia may have no EEG correlates and may not benefit from anticonvulsants. Prolonged and unresponsive seizure must be discussed with the consultant.
- Morphine sedation for comfort during therapeutic hypothermia. Consider low doses if not ventilated.

Imaging:
- Early imaging is relatively insensitive at finding abnormalities. Early ultrasound may be useful to exclude anatomical abnormalities. Ultrasound with dopplers should be done at 48-72hours after birth.
- MRI may be useful (timing as per local guidance)

Sepsis
- Start antibiotics after taking cultures if clinically indicated.
- If using gentamicin, consider the need for early pre dose gentamicin levels and awaiting result because of acute renal injury.

Feeding:
- Consider minimal enteral feeding (trophic) until re-warmed
- Ensure mouthcare using EBM as available.
Feed intolerance is common as gut circulation may have been compromised, this may increase the risk for necrotising enterocolitis (NEC):
- Breast milk is preferable
- Feeds should be introduced gradually

Monitoring:
Monitoring throughout the cooling and rewarming period should include:
- Continuous invasive blood pressure monitoring
- Continuous oxygen saturation
- Continuous respiratory monitoring
- Continuous electrocardiograph (ECG)
- Documented hourly observations including:
  - oxygen saturation
  - heart rate and blood pressure
  - respiration rate
  - urine output
Daily investigations (and more frequently if abnormal):
- blood gases, electrolytes, glucose and lactate (may all be obtained from the blood gas sample)
- full blood count including platelets (which may be sampled from an arterial line)
- Continuous amplitude integrated electroencephalography (aEEG) commenced as soon as possible, if available. This is prognostic and may assist in guiding therapy (treatment of significant electrical seizures may lessen excitotoxic damage)

*Parents*
Senior member of medical team should aim to speak to family as soon as possible to explain level of concerns mentioning risk of death & disability. Discuss use of CFM and cooling if appropriate (see section 6)

*Transfer*
Infants who may require transfer for cooling/intensive care should be referred as early as possible to enable the team to mobilise quickly. These infants will require:
- Full documentation (Badger)
- Xrays
- 2 points of iv access
- Labelled maternal blood sample for cross match

### 6 Parental advice regarding therapeutic hypothermia

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Advice to parent(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resuscitation</td>
<td>Your baby needed significant resuscitation at birth to help him/her breathe. He/she appears to have suffered from the effects of lack of oxygen and blood supply to the brain</td>
</tr>
<tr>
<td>Consequences</td>
<td>This can result in brain damage from direct injury and also from ongoing changes that begin around six hours after the injury</td>
</tr>
<tr>
<td>Prognosis</td>
<td>Babies who survive after this degree of damage to their brain may develop long-term disabilities. These disabilities include cerebral palsy and severe learning difficulties.</td>
</tr>
<tr>
<td>Treatment</td>
<td>In the past there were no treatments to reduce the severity of brain injury in these newborn babies. Recent research has shown that cooling these babies reduces the secondary brain injury, increases the chances of survival by one fifth and reduces the risk of severe long-term disability by one third.</td>
</tr>
<tr>
<td>What does the treatment entail</td>
<td>Your baby will receive cooling therapy in addition to standard intensive care support. Your baby’s temperature will be slowly lowered and kept between 33 to 34°C for 72 hours. Your baby’s temperature and other vital signs will be closely monitored throughout the process. If your baby shows any signs of discomfort during cooling he/she will be prescribed medication to reduce this. After 72 hours of cooling, your baby will be gradually rewarmed to a temperature of 37°C</td>
</tr>
</tbody>
</table>
7 Cerebral Function Monitoring (CFM)

An amplitude-integrated EEG, or Cerebral Function Monitor (CFM), is a device used to measure background electrocortical activity in the brain. An abnormal CFM trace in the first six hours of life, after an asphyxial insult, is predictive of abnormalities on acute neurological testing and long term neurodevelopmental outcome.

A three channel single montage aEEG is commonly used. The site of electrode placement is as described below. Needle EEG electrodes are commonly used and the use of glue may be considered to hold the electrodes in place.

Note that interpretation requires some degree of expertise and therefore CFM may not be appropriate in all settings. The indications for the use of therapeutic hypothermia are clinical and CFM only acts as an adjuvant to this.

Normal CFM:
Sleep wave cycle, upper margin >10µ volts, lower margin > 5µ volts, limited variability

Moderately abnormal CFM:
No sleep wave cycle, upper margin >10 µ volts, lower margin < 5µ volts
Severely abnormal CFM:
No sleep wave cycle, upper margin < 10µ volts, lower margin < 5µ volts, greatly reduced variability

Seizures:
Increased activity, causes CFM to narrow and rise up

8 Complications

Complications of therapeutic hypothermia are infrequent and symptoms may also be related to the effects of the original asphyxial insult on all systems.

Adverse effects which are transient and reversible with warming include ⁸:
- sinus bradycardia
- hypotension requiring inotropic treatment
- increased oxygen requirement
- thrombocytopenia
- Fat necrosis

However, no clinically significant complications related to treatment with cooling in asphyxiated infants have been reported to date ⁹, ¹⁰, ¹¹.

9 Prognosis

Good prognostic features
Stage I encephalopathy
Absence of fits in first 24 hours
Resolution of fits, off anticonvulsants, by 7 days
Ability to suck and feed by 7 days

Poor prognostic features
Stage II/III encephalopathy
Encephalopathy >5 days
Unreactive or discontinuous EEG
Ultrasound evidence of thalamic or extensive parenchymal involvement
**Prognosis by stage of encephalopathy**

Early onset neonatal encephalopathy is the best single predictor of long-term outcome. Quick recovery is associated with a better outcome.

**Stage 1 (Mild)**
Wide-eyed, hyper alert, irritable, weak suck, normal tone. No seizures, normal EEG. Resolves in 24 - 48 hrs. Normal neurologic outcome in greater than 90% of cases.\(^\text{12}\).

**Stage 2 (Moderate)**
Lethargy, little spontaneous movement, hypotonia. Brisk reflexes, sustained clonus, weak or absent suck. Small pupils, doll’s eye movements present, apnoeas. Clinical or electrophysiological seizures. Should resolve within 5 days. Majority normal on follow-up. Risk of abnormality higher if prolonged encephalopathy. Incidence of poor outcomes ranges from 30 - 60%.\(^\text{12}\).

**Stage 3 (Severe)**
Coma, flaccidity, diminished or absent reflexes usually require assisted ventilation. Absent doll’s eye movements, absent gag reflex. Poorly reactive or absent pupillary light reflex. Most die. Severe neurological abnormality in survivors.\(^\text{12}\).

**Prognosis by electroencephalogram abnormality**
Background EEG abnormalities, detected in the first few days of life after HIE can provide prognostic information even in babies treated with hypothermia. Grade of abnormality predicts the rate of death or severe handicap.\(^\text{13}\)

At 6 hours of age a moderately abnormal CFM gives a PPV for disability of 0.23, and a severely abnormal CFM a PPV of 0.55.\(^\text{14}\)

Failure of improvement of the CFM to moderately abnormal/normal by 48 hours of age suggests a 90% chance of death or severe disability.\(^\text{15}\).

**Prognosis by MRI findings**
MRI is an established investigation in the evaluation of neonates with suspected hypoxic-ischaemic encephalopathy (HIE). However, its role as a predictor of neurodevelopmental outcome remains complex.

<table>
<thead>
<tr>
<th>Grade 1 (mild) MR changes</th>
<th>Grade 2 (moderate) MR changes</th>
<th>Grade 3 (severe) changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal outcome</td>
<td>Grade 1 HIE</td>
<td>Death or severe disability</td>
</tr>
<tr>
<td>Normal outcome</td>
<td>Grade 2 HIE</td>
<td></td>
</tr>
</tbody>
</table>

**10 Follow up**
Consider a magnetic resonance imaging (MRI) brain scan with the timing according to local guidelines.
All babies with grade 2 to 3 HIE, and all babies who have received therapeutic hypothermia as treatment for HIE, should be followed up for long term neurodevelopmental assessment to at least 2 years.
If the baby dies the value of a post mortem should be discussed with parents. Organ and heart valve donation should also be considered in these cases.
11 Theory and Evidence of Therapeutic Hypothermia

Neonatal encephalopathy has an incidence of approximately 3/1000 births, with hypoxic-ischaemic encephalopathy occurring in approximately 1.5-2/1000. \(^{17}\)

**A word to use with caution:** asphyxia is a term which is often used in the wrong context, and when used incorrectly may have serious medico-legal consequences. Be careful not to mislabel an infant with low Apgar scores at birth and who requires resuscitation, but has no other problems, as ‘asphyxiated’. It is recommended that the terms ‘perinatal asphyxia’, ‘birth asphyxia’ and ‘HIE’ not be used until or unless there is some available evidence specific to the asphyxial origin for the neurological illness in the baby. “Poor condition at birth” can be used.

Hypoxic-ischaemic insult occurring around the time of birth may result in neonatal encephalopathy. Affected infants may present with a need for resuscitation at birth, neurological depression, seizures and cerebral function monitoring abnormalities. The risk of death or neurodevelopmental abnormalities increases with the severity of the encephalopathy.

**Evidence:**

Results of 11 randomised controlled trials, including the UK total body cooling trial (TOBY) confirm that 72 hours of cooling to a core temperature of 33-34 °C started within six hours of birth reduces death and disability at 18 months of age and improves a range of neurodevelopmental outcomes in survivors.\(^{18, 19, 20, 21}\)

The recent Cochrane review concluded “Therapeutic hypothermia resulted in a statistically significant and clinically important reduction in the combined outcome of mortality or major neurodevelopmental disability to 18 months of age (typical RR 0.75 (95% CI 0.68 to 0.83); typical RD -0.15, 95% CI -0.20 to -0.10); number needed to treat for an additional beneficial outcome (NNTB) 7 (95% CI 5 to 10) (8 studies, 1344 infants). Cooling also resulted in statistically significant reductions in mortality (typical RR 0.75 (95% CI 0.64 to 0.88), typical RD -0.09 (95% CI -0.13 to -0.04); NNTB 11 (95% CI 8 to 25) (11 studies, 1468 infants) and a reduction in neurodevelopmental disability in survivors (typical RR 0.77 (95% CI 0.63 to 0.94), typical RD -0.13 (95% CI -0.19 to -0.07); NNTB 8 (95% CI 5 to 14) (8 studies, 917 infants).”\(^{20}\)

NICE and BAPM support the use of this treatment in selected neonates with HIE.\(^{1, 22}\)

No single factor predicts outcome (death or disability) with absolute certainty. Apgar score alone is a poor predictor of outcome. Apgar scores at 10 minutes provide useful prognostic data before other evaluations are available for infants with HIE. Death or moderate/severe disability is common but not uniform with Apgar scores < 3; caution is needed before adopting a specific time interval to guide duration of resuscitation.\(^{23}\)

In a large series of infants, an Apgar score of 0-3 at 20 minutes was associated with death within one year in 59% of infants and cerebral palsy in 57% of the survivors.

**Actions of hypothermia**

Hypothermia appears to have multiple effects at a cellular level following cerebral injury. Hypothermia reduces vasogenic oedema, haemorrhage and neutrophil infiltration after trauma. In addition mild hypothermia may reduce the activation of the cytokine and coagulation cascades through increased activation of suppressor signalling pathways, and by inhibiting release of platelet activating factor.
Experimental studies show that following hypoxic-ischaemic injury, mild induced hypothermia – a reduction of body temperature by 3-4°C – preserves cerebral energy metabolism, reduces cerebral tissue injury and improves neurological function. Randomised trials in full term and near full term newborns suggest that treatment with mild hypothermia is safe and may improve survival without disabilities up to 18 months of age, but long term efficacy and safety are yet to be established.
12 References

1. NICE Interventional Procedure Guidance 347. Therapeutic Hypothermia with intracorporeal temperature monitoring for hypoxic Perinatal brain injury. May 2010
3. Thoresen M. Who should we cool after perinatal asphyxia? Seminars in Fetal and Neonatal Medicine. 2015; 20:66-71
4. Saliba E. Should we extend the indications for therapeutic hypothermia? Acta Paediatrica 2014 104; 114
5. Austin T, Shanmugalingam S, Clarke P. To cool or not to cool? Hypothermia treatment outside trial criteria. Arch Dis Child Fetal Neonatal Ed 2013, 98; F451-453
15. Thorensen M. Effect of hypothermia on amplitude integrated Electroencephalogram in infants with Asphyxia Paediatrics 2010 126: e130


# POSTURE

**Infant supine.** Look mainly at position of legs but also note arms. **Score predominant posture**

<table>
<thead>
<tr>
<th>Arms &amp; legs extended or very slightly flexed</th>
<th>Legs slightly flexed</th>
<th>Legs w ell flexed but not adducted</th>
<th>Legs w ell flexed and adducted near abdomen</th>
</tr>
</thead>
</table>

- **Abnormal posture:**
  - a) opisthotonus
  - b) marked leg extension, strong arm flexion

# SPONTANEOUS MOVEMENT

**Watch infant lying supine**

<table>
<thead>
<tr>
<th>No movement</th>
<th>Few stretches, no other movement</th>
<th>Jerky movement, stretches, but also some smooth movement</th>
<th>Smooth movement of arms and legs</th>
</tr>
</thead>
</table>

**Fits, cramped or other abnormal movements:**

- DESCRIBE

# SUCK AND GAG

**Watch infant lying supine**

<table>
<thead>
<tr>
<th>No gag/suck</th>
<th>Weak suck only: -Irregular -Regular -No stripping</th>
<th>Infant sucks well on breast</th>
<th>Strong suck -irregular -regular -Good stripping</th>
</tr>
</thead>
</table>

**No suck but strong clenching**

# PALMAR GRASP

**Stroke inside of hand**

**DO NOT TOUCH BACK OF HAND**

<table>
<thead>
<tr>
<th>No reaction</th>
<th>Short, weak flexion of fingers</th>
<th>Strong flexion of fingers</th>
<th>Strong finger flexion, shoulder moves</th>
</tr>
</thead>
</table>

**Strong finger flexion, whole body moves**

# MORO REFLEX

**Bring head forward and suddenly let fall back slightly**

<table>
<thead>
<tr>
<th>No response</th>
<th>Full abduction of the arms, extension at the elbow, no adduction</th>
<th>Full abduction, little or delayed adduction</th>
<th>Arms do not fully abduct but good adduction</th>
</tr>
</thead>
</table>

**Adduction only Extension at the elbow only**

# STARTLE

**Similar movements to moro reflex but when not doing moro test**

<table>
<thead>
<tr>
<th>No startle</th>
<th>Startle to sudden noise</th>
<th>2-3 spontaneous startles</th>
<th>3-5 spontaneous startles</th>
</tr>
</thead>
</table>

**More than 6 spontaneous startles**

# FACIAL APPEARANCE

**At rest and when crying or stimulated**

<table>
<thead>
<tr>
<th>Smiles or reacts to stimuli by closing eyes and grimacing</th>
<th>Closes eyes but not tightly; poor facial expression</th>
<th>Expressionless; does not react to stimuli</th>
</tr>
</thead>
</table>

# EYES

<table>
<thead>
<tr>
<th>Does not open eyes</th>
<th>Normal eye movements, eyes move together</th>
<th>Abnormal eye movements: DESCRIBE</th>
</tr>
</thead>
</table>

**PUPILS RED REFLEX**