

Neuroprotection
Care Pathway
for Infants with
Hypoxic-Ischaemic
Encephalopathy

**Cot-side Decision-Making
Aids for Referring Centres**

**The Scottish Cooling Group in
collaboration with
the Scottish Perinatal Managed Clinical
Network, Belmont Medical and
Inspiration Healthcare**

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Resources for the Decision-Making Process (A-F)

Assessment and identification

- Therapeutic Cooling Decision Aid (A)
- CFM Set-up Aid
- Pre-cooling Documentation Aid (B)

Decision to cool

- Referral SBAR Aid (C)
- Parent Communication Aid (D)

Initiation of cooling

- Tecotherm Set-up Aid
- Early Management Aid (E)
- Transfer Letter Key Requirements (F)

A. Therapeutic Cooling Decision Aid

Resuscitation of baby with suspected asphyxia (NLS)

Admit to NNU where required, for ongoing care and assessment
(If not admitted, assess need for NEWS, ongoing neurological assessment and glucose monitoring)



Prompt stabilisation of airway, breathing and circulation

Maintain normothermia
Avoid hyperthermia

Achieve peripheral access

Update parents

Assess for cooling promptly once stabilised

Assess Criteria A and B

Criterion A

Evidence of intrapartum asphyxia, ANY of the following features:

- Apgar score of ≤ 5 , 10 mins after birth
- Ongoing need for endotracheal or mask ventilation, 10 mins after birth
- pH <7.00 in cord or baby sample within 60 mins of birth
- Base Deficit ≥ 16 mmol/L in cord or baby sample within 60 mins of birth

Criterion B

Moderate or severe encephalopathy (see Neuro Exam table), including ALL of below:

- Altered consciousness (reduced or absent response to stimulation)
- Abnormal primitive reflexes (weak or absent suck or Moro response)
- Abnormal tone (hypotonia, flaccid)
- Or Altered consciousness + seizures alone

A- Yes

A- Yes

A- No

B-Yes

B- No HIE, mild HIE or improving

B -Yes

Neurology severely abnormal or not normalising over first hour:

**Start CFM where available
Start cooling after discussion with cooling centre**

Aim to reach target temperature by 2-4h but **always within 6h**

Reassess B *often*, up to 6h
Low threshold for CFM
Consider early discussion with cooling centre
Maintain normothermia

If encephalopathy progresses within the first 6h:

**Start CFM where available
Start cooling after discussion with cooling centre**

Consider other causes of encephalopathy*
Gather information
Start CFM/USS
Do not cool without discussion with cooling centre

* Includes infection, drugs, neuromuscular/metabolic conditions, stroke, intracranial trauma, structural anomalies etc

The decision to start cooling (active or passive) should **only** be made by a Consultant or Senior Associate Specialist

Document:

- the timing and features of all assessments including CFM where used
- the rationale for initiating or withholding cooling
- the names and seniority of those involved in decision-making
- discussions with parents

Neurological Examination (based on Modified Sarnat scoring system)

Domain	Stage 1 (Mild)	Stage 2 (Moderate)	Stage 3 (Severe)
Seizures	None	Common focal or multifocal seizures	Uncommon or frequent refractory seizures
Level of consciousness	Normal Hyperalert	Lethargic or decreased activity in an infant who may be responsive Can be irritable	Stuporose/ comatose Not able to rouse and unresponsive to external stimuli
Spontaneous activity when awake or aroused	Active Vigorous does not stay in one position	Less than active Not vigorous	No activity whatsoever
Posture	Moving around and does not maintain one position	Distal flexion, complete extension or frog-legged	Decerebrate with or without stimulation (all extremities extended)
Tone	Normal – resists passive motion Hypertonic, jittery	Hypotonic or floppy, either focal or general	Completely flaccid like a rag doll
Primitive reflexes	Suck: vigorously sucks finger or ET tube Moro: normal	Suck: weak Moro: incomplete	Suck: completely absent Moro: completely absent
Autonomic system	Pupils: normal, reactive Heart rate: normal >100 Respirations - normal	Pupils: constricted, reactive Heart rate: bradycardia Respirations: periodic irregular breathing effort	Pupils: fixed dilated, skew gaze, not reactive to light Heart rate: variable may be bradycardic Respirations: completely apnoeic

CFM Criteria for Cooling

CFM should be applied and interpreted by personnel who are trained in its use. This skill includes but is not restricted to:

- Ensuring accurate placement of electrodes
- Ensuring correct machine set up, including appropriate scales and speed
- Accurate interpretation of both aEEG and raw EEG
- Ability to identify artefacts
- Ability to identify normal and abnormal patterns, and accurately diagnose seizures

There must be at least one of the following criteria (based on TOBY criteria) present:

- Moderately abnormal activity (upper margin of aEEG >10 μ V and lower margin <5 μ V)
- Suppressed activity (upper margin of aEEG <10 μ V and lower margin of aEEG <5 μ V)
- Continuous seizure activity as confirmed on both aEEG and raw EEG (rare before 6 hours of age)

B. Pre-Cooling Documentation Aid (0-6h)

Name					Apgar at 10 mins	
Hospital Number					IPPV at 10 mins (not CPAP/PEEP alone)	
Date and time of birth					Worst pH in cord or in first hr	
Gestation					Worst BE in cord or in first hr	
Date and time of assessment (Frequent assessment including at around 5.5h)						
Temperature of baby						
Sedative drugs						
Level of consciousness (alert, lethargic, comatose)						
Spontaneous activity (normal, reduced, absent)						
Respiratory effort (normal, irregular, absent)						
Tone (normal, hypertonia, mild/moderate hypotonia, flaccid hypotonia)						
Moro reflex (normal, weak, absent)						
Suck reflex (normal, weak, absent)						
Gag reflex (normal, weak, absent)						
Doll's eye reflex (normal, weak, absent)						
Clinical Seizures						
CFM: electrical seizures						
CFM: upper limit (uV)						
CFM: lower limit (uV)						
Discussed with cooling centre						
Decision, for example: A. Continue normothermia & assess frequently B. Not eligible: no further assessments necessary C. Further investigations required D. Start cooling						
Assessor name and grade						

C. Referral SBAR Aid

Situation	Who are you? Where are you from? Why are you phoning? Gestation, age and immediate problem
Background	Pregnancy, labour and delivery details Resuscitation details Cord gases and first baby gas Risk factors for infection Is baby small for gestational age? Are there any known abnormalities?
Assessment	Respiratory status with latest gas Cardiovascular status with lactate, heart rate and BP Neurological status as per Pre-cooling Documentation Aid Current temperature and any cooling intervention undertaken Infection: antibiotics and investigations Metabolic: blood sugar Coagulation: eg subgaleal haemorrhage, other bleeding
Recommendation	The plan you have made or wish to discuss

D. Parent Communication Aid

Resuscitation	Your baby needed resuscitation at birth to help your baby breathe. Your baby is showing some effects of a lack of oxygen and blood supply to the brain.
Consequences	This lack of oxygen can result in long term damage from the direct effects at the time, and also from changes that continue after birth.
Prognosis	Approximately 30 to 60% of those babies who survive after this type of event may develop long-term disabilities. These disabilities include cerebral palsy and severe learning difficulties.
Treatment	In the past there were no treatments to reduce the severity of brain complications in these newborn babies. Research has shown that cooling such babies can reduce brain damage resulting from a lack of oxygen, can increase the chance of survival and can reduce the severity of possible long-term disability. Cooling does not help all babies and will only benefit one more baby out of every 7 treated.
What the treatment entails	Your baby will receive cooling therapy as well as standard intensive care. This requires transfer to a centre which provides this specialised care. Your baby's temperature will be slowly lowered and kept between 33 to 34°C for 72 hours using a special machine. Your baby's temperature and vital signs will be closely monitored throughout cooling. Your baby will receive morphine to reduce any discomfort or pain during this time. After 72 hours of cooling, your baby will be rewarmed to 37°C After your baby is at a normal temperature your baby may be transferred back to care in this hospital.
Adverse Event Investigation	The care given during pregnancy and labour to all mothers of babies who require cooling therapy is examined carefully to find out whether this injury could have been prevented. Outline briefly the local investigation process. Avoid giving opinion about any potential breach of duty by caregivers.
Parent Support	Give Parent Information Leaflet from NPC Pathway (Appendix 4). Signpost to organisations if support needed or requested (Appendix 5).

E. Early Management Aid

Parents

- Inform of intention to commence TH and give Parent Information Leaflet
- Support early expression if intention to breastfeed
- Encourage early touch
- Inform about adverse event process

Temperature

- Site rectal probes
- Load with morphine, ensure adequate sedation for neuroprotection
- Start servocooling within 6h, ideally 4h and always within 1h of decision
- Aim to reach 33.5C within 30 min of initiation

Monitoring and Investigations

- Continuous HR, O2 saturation and invasive BP monitoring
- Regular blood gas and glucose analysis

Airway and Respiratory

- Aim for normal blood gas values and saturations
- Avoid hypocarbia /hyperoxia
- Use temperature corrected values
- Intubation is not always required

Cardiovascular

- Achieve two iv cannulae ideally
- Achieve central venous and arterial access only where skilled staff are able
- Bradycardia 80-100bpm is normal
- Aim for mean BP >45mmHg. Treat low BP according to local guidelines
- Avoid excessive fluid boluses and consider inotropes early

Fluids and electrolytes

- Initial maintenance fluids at 40-60ml/kg/d 10% glucose
- Weigh first nappy and record time so balance can be calculated
- Maintain glucose ≥ 2.5 mmol/l: use glucose bolus and increase daily volume or concentration, rechecking every 30mins until glucose level normalises

Gastrointestinal and liver

- Give colostrum as mouthcare where available
- Give vit K
- Coagulopathy is physiological, only active bleeding needs treatment.

Infection

- Take blood cultures and give antibiotics within one hour of birth
- Record all risk factors in transfer letter
- Ensure placenta is sent for pathological examination

Neurology

- Continuous CFM
- Treat seizures only after discussion with cooling centre as these are rare in first 6h after asphyxia. Non-epileptic abnormal movements are common.

F. Transfer Letter Key Requirements

Pregnancy	<ul style="list-style-type: none"> Fetal anomaly scan Episodes reduced movements Infection risk factors Other relevant history
Birth	<ul style="list-style-type: none"> Infection risk factors Meconium Mode of birth CTG abnormalities as described by maternity staff Has placenta been sent for exam? Cord gases
Resuscitation	<ul style="list-style-type: none"> Status at birth Time to first gasp Time to first HR >100 All interventions received
Admission	<ul style="list-style-type: none"> First blood gas including sugar Details of criteria A, B and C- detailed neurology description as per proforma Time to decision to cool Time to target temp 33.5C Head circumference
Early care	<ul style="list-style-type: none"> Latest blood gas Drug dosages and timings All interventions received Blood test results and those awaited XR findings including line positions USS findings
Parents	<ul style="list-style-type: none"> What have they been told? Any relevant social information Any relevant family history