

THAMES VALLEY & WESSEX NEONATAL OPERATIONAL DELIVERY NETWORK

THERAPEUTIC COOLING GUIDELINE: NURSING CARE ON THE NEONATAL UNIT

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Related documents / References	<p><u>References</u></p> <p>Adams.A et al (2023) <u>Thames Valley & Wessex guidelines for assessment and initiation of therapeutic hypothermia (cooling) treatment for babies presenting with moderate or severe hypoxic ischaemic encephalopathy</u>. TVW Neonatal ODN,</p> <p>BAPM (2020) <u>Therapeutic Hypothermia for Neonatal Encephalopathy. A framework for practice</u>. November 2020. British Association of Paediatric Medicine. London.</p> <p>Bliss (2023) <u>HIE (Hypoxic-ischaemic encephalopathy): Information for parents</u>. Bliss, London. Found at https://shop.bliss.org.uk/en/products/parent-resources/hie-a-guide-for-parents</p> <p>N.Chirinian (2011) Therapeutic Hypothermia for Management of neonatal asphyxia: What nurses need to know. <u>Critical care Nurse</u>. June 2011, Vol 31, No 3, ppe1-e12.</p> <p>Fairchild. K et al (2010) Therapeutic hypothermia on neonatal transport: 4 year experience in a single NICU. <u>Journal of Perinatology</u>, Vol 30, pp324-9.</p> <p>Jackson.A (2010) <u>Therapeutic hypothermia for hypoxic-ischaemic encephalopathy-cooling centre guidelines</u>. NHS Greater Glasgow and Clyde.</p> <p>Kelly.K.J (2021) <u>The Nurses's role in neonatal therapeutic hypothermia</u>. Northern Illinois University. De Kalb Illinois.</p> <p>Kendall.G et al (2011) Passive cooling for initiation of hypothermia in neonatal encephalopathy. <u>Archives of disease in childhood, fetal and neonatal edition</u>. 2010,</p>

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<p>Implications of race, equality & other diversity duties for this document</p>	<p>This guideline must be implemented fairly and without prejudice whether on the grounds of race, gender, sexual orientation or religion.</p>

Version Control:

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Therapeutic Cooling: Nursing Care Guideline

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1.0 Aim of Guideline

To provide a framework for carrying out therapeutic cooling on Neonatal Units in Thames Valley & Wessex Neonatal ODN.

2.0 Scope of Guidelines

The Guideline applies to all Neonatal Units and Maternity Units covered by Thames Valley & Wessex Neonatal ODN. This includes the following hospitals:

Thames Valley		
TRUST	Hospital	Designation
Oxford University Hospitals NHS Foundation Trust	- John Radcliffe Hospital, Oxford	NICU
Buckinghamshire Healthcare NHS Trust	- Stoke Mandeville Hospital, Aylesbury	LNU
Frimley Health NHS Foundation Trust	- Wexham Park Hospital, Slough	LNU
Milton Keynes University Hospital NHS Foundation Trust	- Milton Keynes General Hospital	LNU
Royal Berkshire NHS Foundation Trust	- Reading	LNU

Wessex		
TRUST	Hospital	Designation
University Hospital Southampton NHS Foundation Trust	- Princess Anne Hospital	NICU
Portsmouth Hospitals University NHS Trust	- Queen Alexandra Hospital	NICU
Dorset County Hospital NHS Foundation Trust	- Dorset County Hospital, Dorchester	SCU
Hampshire Hospitals NHS Foundation Trust	- Basingstoke and North Hampshire Hospital	LNU
Hampshire Hospitals NHS Foundation Trust	- Royal Hampshire County Hospital, Winchester	LNU
Isle of Wight NHS Trust	- St Mary's Hospital	SCU
University Hospitals Dorset NHS Foundation Trust	- Poole Hospital	LNU
Salisbury NHS Foundation Trust	- Salisbury District Hospital	LNU
University Hospitals Sussex NHS Foundation Trust	- St Richard's Hospital, Chichester	SCU

3.0 Guideline Summary

- Normothermia should be maintained during resuscitation, with clinical assessment for cooling taking place only after the patient has been stabilized, following resuscitation.
- For passive cooling - follow local policy or network guideline
- For active cooling – follow local policy or network guideline
- During cooling continuously monitor and record hourly.
 - Heart rate
 - Respiratory rate
 - Oxygen Saturations
 - Invasive blood pressure
 - Surface temperature –from cooling machine surface probe
 - Core temperature-from cooling machine rectal probe
 - Set temperature- from cooling machine
 - 2nd rectal temperature – from unit monitor, as a safety back up
 - Pain score

- Position the baby with the head in line with the body to avoid impairment to cerebral blood flow return.
- All babies who are receiving active cooling must be placed on CFM monitoring.
- Cooled babies should be observed closely for signs of electrical and clinical seizures.
- If the baby's heart rate is greater than 110 then pain/ distress, hypovolaemia or hypotension should be considered.
- When doing blood gases, the actual temperature of the baby should be inputted into the gas machine, allowing the blood gas to be corrected for temperature.
- Every 3-6 hours open the cooling jacket and assess the baby's skin, then reposition the baby so that the area of skin under maximum pressure is altered.
- Rewarming begins after 72 hours of cooling. The local medical guideline or network guideline for rewarming should be followed.
- The CFM remains monitoring the baby for 24 hours after rewarming has been achieved.
- A rectal probe remains in situ for 24 hours after rewarming has been achieved.
- Keep parents informed about all aspects of their baby's care and encourage them to participate in their care, as appropriate. This may include cuddling their baby with the cooling wrap and monitoring equipment in place.

4.0 Definition of terms

'Therapeutic Cooling' (TC or 'cooling')

The process of lowering a baby's body temperature, in order to lower their deep brain temperature to 33-34 °C. This cooling has been found to have a neuroprotective effect by modifying cells programmed for apoptosis and possibly reducing cerebral metabolic rate.

'Apoptosis'

Programmed cell death. Cells die in response to a variety of stimuli and during apoptosis they do so in a controlled, regulated manner.

'Hypoxic-Ischaemic-Encephalopathy' (HIE)

A lack of sufficient oxygen to the brain and a diminished amount of blood perfusing the brain. This results in suppression of electrical activity and cortical depression.

'Passive cooling'

A technique used within low dependency nurseries to cool a baby, during the stabilization process, prior to transfer to a neonatal Intensive care unit for active cooling. No equipment is required for the cooling, but the baby must be carefully monitored so they don't become hypothermic.

'Active cooling'

A technique to therapeutically cool a baby using designed for the purpose cooling equipment, with a servo controlled temperature regulation system. Care of the neonate will follow a standard operating procedure for medical and nursing care throughout the process.

5.0 Background information

TC has been found to be beneficial for term newborns with HIE. Research has shown that without intervention, a baby who has moderate encephalopathy after birth has a risk of death of less than 10%, but their risk of surviving with a physical disability is approximately 33%. Research has also shown that for babies demonstrating severe encephalopathy, the risk of mortality is up to 60%, with the majority of babies who survive going on to have disability at age 18 months of age.

The use of TC for a 72 hour period after birth has been found to reduce mortality without increasing major disability in survivors. Research studies have identified that the benefits of cooling outweigh the possible short term adverse effects of the cooling process. However, the current evidence does not support the cooling of infants with mild HIE, or those born before 36 weeks gestation.

When HIE occurs, the lack of oxygen and blood flow can result in permanent brain injury, however where therapeutic cooling treatment is provided to the baby, it is found to have a neuroprotective effect, by modifying the cells programmed for apoptosis, leading to their survival in greater numbers than would have occurred without the therapeutic hypothermia. TC may also protect neurons by reducing cerebral metabolic rate.

These guidelines have been produced to direct nursing staff in their care of neonates receiving therapeutic cooling and are based on research findings and agreed current best practice. This nursing guideline is intended to complement medical guidelines for therapeutic cooling, so offers generic guidance on safe and effective nursing care of babies requiring cooling. User instructions for different medical devices will not be given, as user manuals and local training procedures should be covering this aspect of care. Specific discussion of a particular medical device will only be made- if pertinent to improving nursing care.

For accessibility, the guidelines have been collated under distinct subheadings, in the order that information is likely to be needed in practice. However, the reader is strongly advised to read the guidelines in full and to seek the advice and support of more senior or experienced colleagues in the practice setting.

6.0 Guideline framework

6.1 Before a decision to cool is made.

- Normothermia should be maintained during resuscitation (Resuscitation Council (UK) 2015).
- The clinical assessment for cooling should only take place after the patient has been stabilized following resuscitation.
- TC (either passive or active cooling) should not be commenced until the infant meets the clinical criteria for cooling, which requires a neurological assessment **after at least 30 minutes of age**. In all but the most severe cases, ***this assessment will take place following transfer to the neonatal unit.***
- Babies born outside a hospital setting (e.g., at home, or standalone midwifery unit), who require a significant resuscitation, should, where possible, be nursed on a Transwarmer, with suitable clothing, hat and blankets during ambulance transfer to avoid excessive hypothermia. The patient should be kept normothermic until stabilization has occurred at the receiving hospital. Following this, a formal neurological assessment can be completed, and decisions made about whether cooling therapy should be commenced.
- If attending a delivery where the baby requires significant resuscitation or is born in very poor condition, nursing staff can prompt the resuscitation leader, as it may be appropriate to ensure venous and arterial cord gases are taken.
- Whilst awaiting a definite decision to cool, ask a team member to gather equipment that would be required if the decision is made to commence therapeutic cooling. This will enable cooling to commence in a timely and efficient manner, if this decision is made to proceed to therapeutic cooling.

6.2 Commencing Cooling.

Follow cooling protocol for local unit, either **Passive Cooling** or **Active Cooling**. This will always include the fundamentals below;

- Turn incubator or overhead heater off
- Do not dress the baby
- Do not cover the baby
- Do not nurse baby on heat retaining surface such as 'sheepskin'
- Do not use ice packs- as severe hypothermia can result
- Do not use a fan without rectal probe in situ.
- The temperature range desirable for formal cooling is 33-34°C. This cannot be measured using an axilla thermometer as they are not accurate at such low temperature levels.
- Site a rectal temperature probe.
 - Mark with white tape around the probe, 1cm longer than the depth you intend to insert it. It will then be very clear if the probe position has moved.
 - Lubricate probe with lubricant gel.
 - Place probe 3-6cm deep into the rectum- depending on the size of the baby, unless cooling machine instruction manual directs otherwise.
 - Secure the probe to the upper thigh.
 - Document initial temperature (rectal if available)

Staff should be aware that once a baby is cooled their peripheral perfusion will be reduced, which may make it more difficult to site peripheral venous lines (pvl). Staff may choose to site one or more pvl before commencing cooling- although it is important that the commencement of cooling process is not delayed.

6.3 Monitoring

- Continuously monitor and record hourly;
 - Heart rate
 - Respiratory rate
 - Oxygen Saturations
 - Invasive blood pressure
 - Surface temperature –from cooling machine surface probe
 - Core temperature-from cooling machine rectal probe
 - Set temperature- from cooling machine
- During the initial cooling process there is a risk that the baby will be over cooled or under cooled, especially if passive cooling is occurring. To mitigate against this some units choose to record the baby's heart rate, respiratory rate and core temperature every 15mins for the first 1-2 hours of the cooling process, until the level of hypothermia has stabilised. **Ensure you follow your locally agreed policy on this.**
- Urine output should be measured 6 hourly as renal function can be compromised, both by the cooling process and the hypoxic insult.
- As a safety measure, some units will use a second rectal probe to measure core temperature. This is because of the rare chance of the cooling machine being faulty. If using a second probe, document this reading hourly and compare to core temperature reading from cooling machine.
- Report any deviation between the readings, greater than 0.2 °C to a senior nurse or the medical team.
- The rectal probe can be left insitu for the full time period of cooling and re-warming. It does not need to be removed and routinely cleaned during this time.
- The average heart rate for a cooled baby is 100. If the baby's heart rate is greater than 110

then pain/ distress, hypovolaemia or hypotension should be considered. If the baby is on significant amounts of inotropes, then an elevated heart rate may be acceptable- but always report an elevated heart rate to the medical team.

- The standard parameters for heart rate and respiratory rate alarm settings should be altered according to the status of each baby.
- The baby should have a pain score assessed and recorded hourly, due to the high probability of pain or discomfort. Observation should also include indicators such as tone and alertness that may indicate a changing neurological status or development of seizures.
- Babies who are cooled, tend to have an elevated blood pressure. If the baby's blood pressure falls below 40mmHg, inform the medical team as active management may be required.
- A UAC and UVC will usually be sited for babies being cooled. As with any arterial line, the peripheral perfusion of the tissues proximal to the arterial line must be checked regularly. Although the baby's skin colour and temperature will be affected by the cooling process, the perfusion, colour and temperature of the lower limbs can be checked by comparing them to the perfusion, colour and temperature of upper limbs, which are unaffected by any arterial line. Document these observations hourly.

6.4 General Care

- If baby is receiving respiratory support, the heating and humidification levels should be set to their 'normal' settings.
- Respiratory secretions tend to be sticky when a patient is cold. Cooled babies are likely to require more frequent suctioning – particularly on the 3rd day of cooling. This is important to help prevent chest infections.
- When doing blood gases, the actual temperature of the baby should be inputted into the gas machine, allowing the blood gas to be corrected for temperature.

Enteral feedings are indicated in the cooling patient, but due to an increased risk of Necrotising Enterocolitis (NEC), milk feeds will be introduced cautiously. When available, breast milk would be used as a first preference. For those infants with severe HIE the medical team may decide to delay feeding until after the infant has been rewarmed.

- Hypothermia can affect coagulatory function, so staff should be vigilant for signs of bleeding such as bruising, excessive bleeding after heel-prick or veni-puncture and petechiae.
- It has been suggested that blood flow to the cooled baby's brain may be compromised if the baby is positioned during cooling, with its head turned to the side. The evidence base for this is unclear, but it seems sensible to nurse the baby where possible with the head in line with the baby's body (this may be supine or lateral) and to avoid extreme extension, contraction or twisting of the baby's neck.
- It is usual practice for cooled and ventilated babies to be sedated with intravenous morphine.
- It is common practice for non-ventilated babies to receive a low level of intra-venous morphine (10cmg/kg/hr). The baby's respiratory function will need to be monitored closely using continuous respiratory monitoring and careful observation.
- If you feel the baby is distressed or in pain, inform the nurse in charge, or the medical team. Pain relief and sedation can be increased, even if this requires commencing ventilation, to do this safely.

6.5 Skin Integrity

- Babies being cooled have poor peripheral perfusion, reduced mobility and increased risk of fat necrosis. Every 3-6hours dependent on the baby's condition;
- Open the cooling jacket and assess the baby's skin, taking particular note of areas over the bony prominences, such as buttocks and spine.
- Reposition the baby, so that the areas of skin under maximum pressure are altered.
- Nursing the baby in the midline position does not require that they always be positioned supine. Midline positioning can be achieved with the baby nursed laterally, left or right and also a 'slightly tilted' position to the left or right.

6.6 Cerebral Function Monitoring

- Where available, babies who are being cooled will have their cortical brain activity continuously monitored using a cerebral function monitor (CFM). An amplitude-integrated-electroencephalogram (aEEG) will be displayed on the CFM for continuous viewing and also recorded by the CFM.
- If CFM is available, it will be sited by someone competent to do so - this may be a member of the medical or nursing team.
- CFM may not be available during the initial assessment phase, or on units that passively cool, however, all babies who are receiving ongoing active cooling must receive CFM monitoring.
- Observe closely that the sub dermal needle electrodes do not become dislodged. Electrode dislodgement will cause the aEEG trace to be interrupted or become poor quality. Some machines have a traffic light system to guide staff, and will go from green, to amber or red if the trace quality reduces and action is required.
- Changes in the aEEG trace can indicate clinical or subclinical seizures or alteration in brain function and should be reported to the medical team.
- Whilst the baby is on the CFM all significant events should be 'marked'. This means recording the time and type of event against the aEEG trace, so any change in the aEEG can be understood in light of the event. See the machine's instruction manual for how to mark events. Events that need to be marked include;
 - Handling or medical procedures.
 - Seizures or abnormal movements observed.
 - Administration of anti-convulsants.

6.7 Risk of Seizures

- Cooled babies should be observed closely for signs of clinical seizures, which may include;
 - Lip smacking
 - Jerking movements of one or more limb
 - Back arching
 - Facial twitching
 - Eye rolling
 - Cycling of limbs
 - Excessive hiccupping
- The nature of seizures and length of time of each episode spans should be documented in the nursing record as well as marked on the CFM.
- Report all episodes of clinical seizures to the medical team and treat as local policy directs.

- Babies having sub-clinical seizures may display subtle signs externally- for example vacant expression, sudden stillness, sudden agitation, apnoea, desaturation, or bradycardia. If these signs are seen, seizure activity may be noted on the CFM aEEG trace. Report such external signs or any possible CFM changes to the medical team.

6.8 Documentation

- It is usual practice to document these values every hour
 - Heart rate
 - Respiratory rate
 - Oxygen Saturations
 - Invasive blood pressure
 - Surface temperature –from cooling machine surface probe
 - Core temperature-from cooling machine rectal probe
 - Set temperature- from cooling machine
- If local policy in your unit, document heart rate, respiratory rate and core temperature every 15 minutes for the first 2 hours, when hypothermia is stabilizing.
- There are specific forms that need to be completed, showing how each baby is assessed and why the decision was made to commence therapeutic cooling. This will be completed by the medical team, usually the registrar and can be found in the Thames Valley and Wessex ODN Neonatal Network Medial Guideline for Assessment and Initiation of Therapeutic Hypothermia.

6.9 Rewarming

- Rewarming will usually begin after 72 hours of cooling, unless the decision to cease cooling is made earlier.
- Follow the local medical guideline for rate and time interval of rewarming.
- Some cooling equipment requires the nurse caring for the baby to change the target temperature setting every half an hour, gradually bringing the baby's core temperature up from 33.5°C to 36.6°C, over a number of hours. Other machines have an automated rewarm setting, that will do this rewarming process slowly and steadily using their servo-controlled feedback systems.
- The risk of seizures is higher during and after rewarming, so the babies should be vigilantly monitored during this period.
- The baby's blood pressure should be watched vigilantly during rewarming, as the risk of low blood pressure increases as the baby's temperature rises back to 'normal'.
- If complications (seizures or hypotension) occur, inform medical staff and reduce the temperature back down to the temperature at which the baby was previously stable. Further rewarming may need to be done more slowly.
- The cooling wrap can usually be removed 1 hour after normothermia has been achieved. See individual instructions for equipment in the local area.
- The CFM would usually remain monitoring the baby for 24hours after rewarming has been achieved.
- To ensure the baby's temperature remains stable after rewarming a rectal probe would usually remain in situ for 24hours. It does not need to be the probe from the cooling machine if it is more convenient to remove the machine.

6.10 Parents

- Verbal Parental assent is required for cooling. This will be taken by the medical team and recorded in the baby's medical notes.
- If a baby is being cooled outside of standard guidelines, medical staff will ensure that parents are aware that treatment is not proven in this situation (see medical guidelines for standard criteria for cooling)
- Separation of the baby and mother/father is a significant issue when a term baby is unexpectedly admitted to the neonatal unit for cooling. This is exacerbated if the baby requires transfer to a tertiary centre for cooling, and the baby ends up in another hospital. Every effort should be made to;
 - Keep parents informed and involved
 - Encourage parental visiting and residence on site wherever possible
 - Facilitate positive touch/ cold cuddles as possible/ appropriate
- Parents should be given a copy of the Bliss HIE - Information Leaflet for Parents (available free of charge on www.bliss.org.uk) or the local hospital information leaflet. If the medical team have not, then nursing staff can always offer this to parents.
- Parents should be offered information about other forms of support for parents and families with a baby who has HIE and requires cooling. These include.
 - PEEPS HIE charity who provide information, support, counselling, therapy, funding, and offer free parent packs, which many units will already have stored for when required. See online at peeps-hie.org
 - Bliss, charity for babies born sick or premature. See online HIE information for parents at:

<https://www.bliss.org.uk/parents/about-your-baby/medical-conditions/hypoxic-ischaemic-encephalopathy-hie>

- Explain to parents that their baby will feel cold for the duration of treatment.
- Reassure them that their baby will be kept comfortable for the duration of the treatment.
- Keep parents informed about all aspects of their baby's care and encourage them to touch and interact with their baby, and participate in their care, as much as they would like to and is appropriate.
- If the baby is clinically stable then it is safe and acceptable for parents to 'cold cuddle' the baby, with the cooling wrap insitu. Care needs to be taken that CFM leads are not dislodged and that the water feed in hoses for the cooling wrap are not accidentally kinked.

6.11 Neurodevelopmental needs and support for the cooled baby

- Each baby being cooled will be in a different stage or situation with regards to their pain, discomfort, level of consciousness, gestational maturity and medical instability. This means that one way of managing their neurodevelopmental and comfort needs will not be suitable for every baby.
- Nursing and medical staff must take care to consider a wide range of factors, and then individualise the care that they give each and every shift, as the baby's situation and health status changes.
- Principles that should be considered for every baby include;
 - Provide the baby with boundaries which they can brace their feet against, and can help with comfort and regulation.

- Regular mouth care with mother's colostrum, if available. Provides a positive taste experience, enhances comfort and reinforces the importance of Mother's presence.
- Providing parental scent to the baby on bonding squares, muslins or similar and allowing parents close so they can in turn smell their baby.
- Parents reading or singing softly at the bedside, lets the baby know their parents are there, and provides comfort and reassurance to all.
- Protect baby's eyes from the bright lighting of the neonatal unit, using a incubator cover, or cot canopy as appropriate.
- The auditory pathway in the brain is particularly vulnerable to injury during cooling, so consider nursing babies with 'minimuff' ear defenders', and keep noise levels low around cooled babies.

7.0 Appendices

Appendix 1

Cerebral function monitoring in Infants. A free to access course from the east of England Network. (BAPM, 2021)

The course contains the following modules:

1. What is cerebral function monitoring?
2. How to interpret the cerebral function monitor trace
3. When to commence cerebral function monitoring
4. Case studies

This course has been developed by Dr Chuen Wai Lee and Dr Claudia Chetcuti Ganado on behalf of the East of England Neonatal ODN.

See link here. <https://www.bapm.org/resources/cerebral-function-monitoring-in-infants>

Appendix 2

An educational package consisting of 3 videos relating to diagnosis and management of Infants with Hypoxic-Ischaemic Encephalopathy (HIE).

This educational resource package has been developed to assist with training and educating clinical staff within delivery units to be able to make clinical decisions in accordance with Neuroprotection Care Pathway for Infants with HIE. The aim is for the infants to be identified for cooling treatment appropriately, within the specified time period and for parents and families to experience excellent communication from members of the team caring for the infant.

Resource 1 -Video - Neurological examination of a baby with suspected Hypoxic Ischaemic Encephalopathy (HIE) – an essential guide to selecting babies for therapeutic hypothermia.

Resource 2 – Video - Supporting Communications Skills – Diagnosis and Treatment – a short video to assist you in thinking about how and what you might say during those early conversations.

Resource 3 – Supporting Communications Skills - Prognosis and Ongoing Management – meeting with parents to discuss prognosis is a key moment in their neonatal journey. It is important to approach this meeting with preparation, information and support.

See link below; <https://learn.nes.nhs.scot/62008>