Ashford and St. Peter's Hospitals
NHS Foundation Trust

Thermoregulation in the Neonatal intensive care unit

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Guideline History		
Date	**Comments**	**Approved By**
March 2021		NGG

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Contents

Thermoregulation in NICU

a. Introduction

Thermoregulation is the capacity to maintain equilibrium between heat loss and heat production in order to sustain body temperature within a normal range. Hypothermia and hyperthermia may have serious effects on the newborn particularly preterm infants. Hypothermia can increase morbidity and mortality as it can lead to other harmful side effects such as hypoglycaemia, respiratory distress, hypoxia, metabolic acidosis and poor weight gain (McCall et al, 2010). Hypothermia has also been linked to unnecessary admissions of term infants to neonatal units (NHS improvements, 2017). The maintenance of the neural thermal environment is the ultimate aim of neonatal temperature control and management.

Hyperthermia ≥37.5°C
Normal Temperature 36.6°C to 37.5°C
Hypothermia ≤36.5°C
Severe hypothermia <32°C

b. Purpose

The purpose of this guideline is to give guidance on maintaining a neutral thermal environment for the infant at all times and to minimise risk associated with hypothermia and hyperthermia.

Signs of Hypothermia

- Shallow breathing, apnoea and bradycardia
- Decreased activity and lethargy
- Hypotonia with reduced reflexes
- Pale mottled skin – cool to touch, cold extremities
- Weak suck, poor feeding, poor gastric emptying, abdominal distension
- Hypoglycaemia

Signs of hyperthermia

- Tachycardia, tachypnoea, apnoea
- Hypotension
- Warm extremities, perspiration
- Lethargy, hypotonia, poor feeding

Methods of heat loss in the infant

Understanding the mechanisms of heat loss in infants is important to be able to minimise the effect. Infants lose heat through their skin and respiratory tract to the environment through evaporation, radiation, convection and conduction.

- Evaporation- Heat is lost when water evaporates from skin or breath.
- Convection- Heat is lost to currents of air
- Radiation – Heat is lost from skin to surrounding surfaces.
- Conduction – Heat is lost to surfaces which the baby is in direct contact with.

c. Delivery Room Care- For stable term infant and for preterm infants >32 weeks gestation

- Ensure that the delivery room and theatre room is kept warm.
- Windows and doors should be shut and fans turned off to limit draughts.
- Supplementary heating such as resuscitaires or transwarmers should be available if required.
- Towel warmers are available in HDU on labour ward and NICU annexe.
- Cover the infant with a pre-warmed towel to reduce evaporation heat loss, while allowing for delayed cord clamping (DCC) up to 3mins.
- Whilst being assessed and delayed cord clamping continued, the baby should be on a warm surface- either the mother's chest/abdomen or on another warmed towel.
- Remove any wet towels.
- If the infant remains with mum then place skin to skin with pre-warmed towels over the infant.
- The head should be covered with a hat to prevent heat loss.
- If the baby is to be transferred to NICU, the infant should be wrapped in warm, dry towels and transferred to NICU on the resuscitaire or in a cot, with appropriate monitoring or respiratory support.
- Measure the temperature if there is suspicion that the baby is becoming hypothermic or if the baby required prolonged resuscitation at birth.
- Act to normalise temperature by using additional ward towels or transwarmer as required based on baby's temperature prior to transfer to NICU.
- Check mothers temperature if baby is hypothermic despite skin to skin
- Document all actions taken to maintain normothermia with a time line in resuscitation records (Maternity or NICU BADGER)

d. Delivery Room Care- For the preterm infant <32 weeks gestation, unwell term infant or severe growth restricted infant

- Ensure that the delivery room is warm and theatre is warm. Document room temperature and mothers temperature in stabilisation chart.
- Windows and doors should be shut and fans turned off to limit draughts.
- Radiant heaters/resuscitaires should be turned on to the maximum.
- Towels and hats should be warming on the resuscitaire.
- Prepare LifeStart with Transwarmer placed at the end of the LifeStart platform for <28 weeks gestation, where baby is likely to be placed after birth to enable delayed cord clamping (DCC) for up to 3 minutes.
- Always use NeoHelp bags on LifeStart for **<32 weeks gestation** and **IUGR babies.**
- Place baby into NeoHelp bag taking care to cover head fully but leave the face free.
- Take 20seconds to fully close the bag, leaving only the saturation lead outside. The arm should be inside the bag. **Do not** make any holes in the bag for the arm to come out.
- Do not open the bag to listen to the chest or examine the baby as the bag is clear and allows good assessment of the baby. Aim to have DCC on the LifeStart platform from 1-3 minutes, to ensure the baby has established breathing before cord clamping.
- Even in unwell term infants, aim to do DCC for up to 1 minute until breathing is established before clamping cord.
- If it is not feasible to use Lifestart, carry out DCC on mothers thighs or between her legs, using transwarmer underneath. Sterile drape can be used if in theatre to cover transwarmer.
- Check axilla temp after DCC
- Do not use Transwarmer on the resuscitaire, with the radiant heating on.
- Do not cover the polythene bag with towels as this will prevent heat from reaching the infant
- Only place a hat on the baby's head if not using a NeoHelp bag
- If the polythene bag is visibly wet with a lot of amniotic fluid, blood, urine or stool at any point, please change the bag to a clean one,
- If the resuscitation is prolonged the output from the radiant heater should be adjusted as necessary or a Transwarmer considered carefully
- For term infants who might seem to have Hypoxic ischaemic encephalopathy- **Do not** initiate therapeutic hypothermia while on the resuscitaire. Aim of resuscitation is to have normothermia.

e. Please see Standard operating Procedures (SOP) for DCC and training video on DCC:

SOP for DCC:

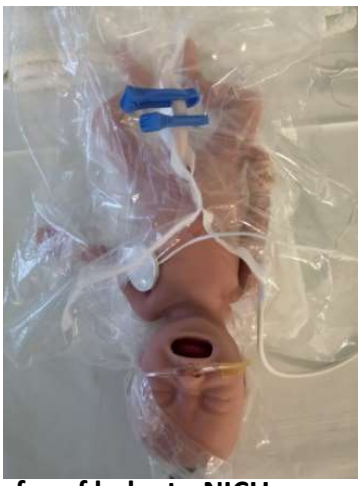
http://trustnet/docsdata/paed/Guidelines_Neonatal/SOP%202%20Less%20than%2032%20Weeks%20DCC%20Jun%202019.pdf

Training video on DCC:
http://trustnet/docsdata/paed/neo-education.html
Under Delayed cord clamping

f. Continuous temperature monitoring

- For use in infants <32 weeks gestation to help maintain normal temperature throughout stabilisation on labour ward
- Currently being used only on Panda resuscitaires with a designated probe
- Once Drager Monitors are updated in NICU, aim to take the handheld portal with the correct probe to the delivery to use for all expected admissions to NICU for continuous temperature monitoring.
- Position continuous temperature probe under left axilla and secure with a small piece of duoderm (See picture **A** below)
- The probe is connected to the Panda resuscitaire on the right side (See picture **B** below)
- Use the manual mode and adjust the radiant heater as required
- Aim to write down the continuous temperature every minute on the resuscitation record whilst on labour ward. If significant deviations, check with axilla temperature to corroborate.
- Routinely take the axilla temperature of the baby around 3mins after DCC, prior to birthday cuddle and before leaving labour ward- act on the temperature as necessary and document all actions in the resuscitation records.
- Remember to disconnect the temperature probe when taking the baby for a cuddle.

Picture A



Picture B

g. Prior to transfer of baby to NICU

- Ensure baby is stable and covered fully in the Neohelp bag with head fully covered. Obtain additional warm towels for transfer, as the resuscitaire is not a source of heat whilst unplugged for transfer.
- Take axilla temperature prior to disconnecting the resuscitaire.
- If axilla temperature is <37 degrees then transfer baby on a transwarmer on the resuscitaire. The Transwarmer used on LifeStart for DCC should be used instead of a new one.
- Once resuscitaire is unplugged, the transfer should be swift and completed within 5 minutes. Obtain extra help if needed to hold doors open or move equipment, prior to disconnecting resuscitaire.

On admission to NICU

- Incubator should be pre-warmed to 35 degrees and humidity set at 80% as soon as admission is expected.
- The preterm infant should be placed into the incubator in their polythene bag immediately without any delay.
- If polythene bag is particularly wet with amniotic fluid, urine, blood or meconium then remove bag from baby
- If the incubator temperature is not achieved at the point of baby being placed inside, use another Neohelp bag, if the bag needs to be removed due to wet fluid.
- If the polythene bag is reasonably dry then keep the baby in the bag until after cannulation and observations have taken place
- Settle baby in the incubator, allow baby to stabilise before taking the axilla temperature at 30-60mins post birth.
- In the first 30minutes on the NICU, refrain from opening the incubator doors. Only open for stabilisation, observations and cannulation according to the priority as instructed by the senior doctor leading the admission.
- The first temperature at admission needs to be taken within 1 hour and documented in admission notes and BADGER.
- Optimise the environment and then check the temperature. The first admission temperature is a marker of care provided in NICU, and is a national benchmarking under NNAP (National Neonatal Audit Programme)
- All actions taken by the doctors and nurses to maintain normothermia should be documented in their respective notes and this will be audited regularly.

- If prolonged persistent hypothermia despite active management, consider sepsis as a differential diagnosis.

Babyleo Incubator

The Babyleo incubators are useful particularly in preterm or low birth weight infants as they have additional features to stabilise temperature including-

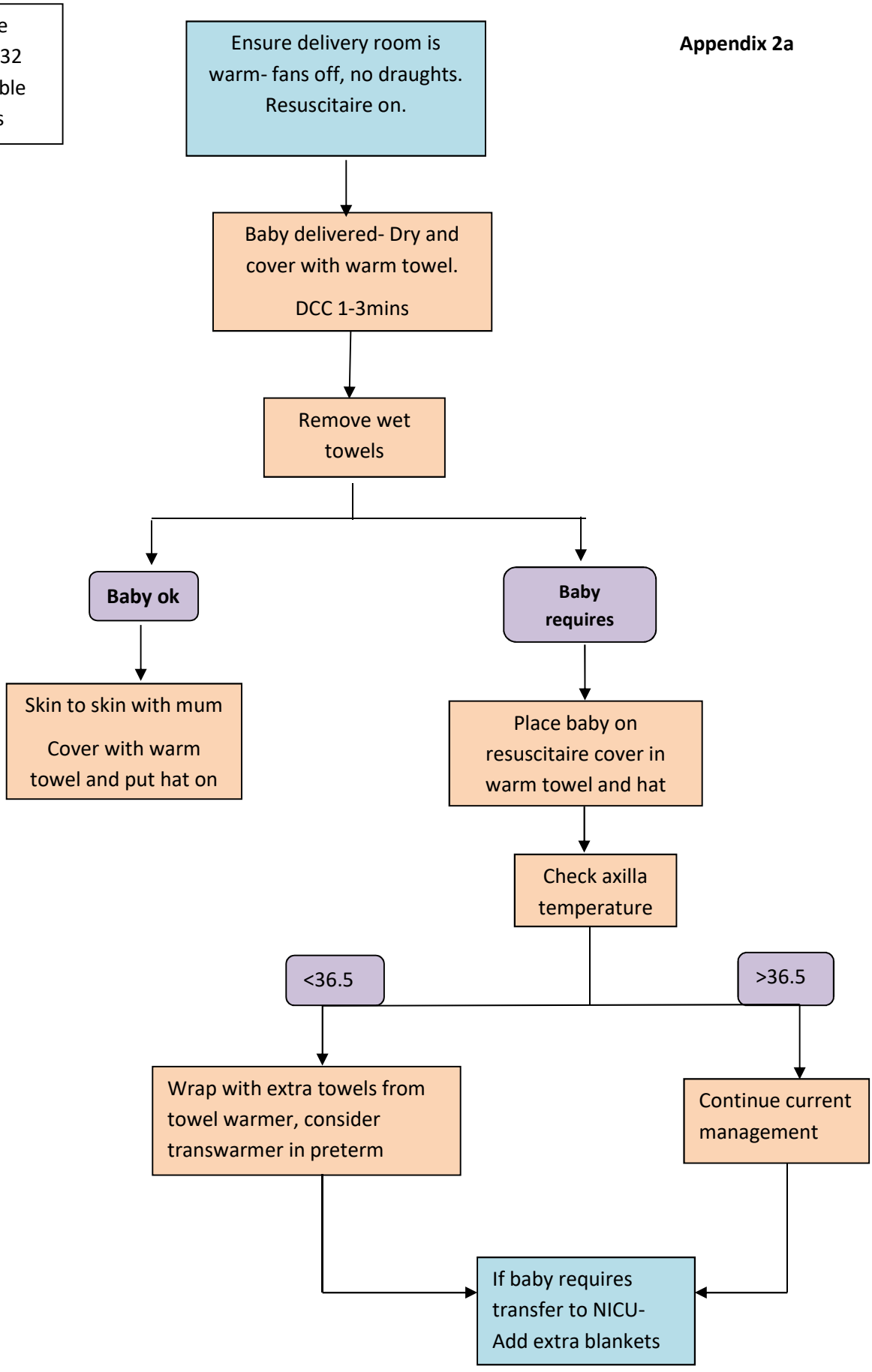
- Convection heater- To provide incubator environment heating.
- Overhead radiant warmer- For extra heat during procedures.
- Heated mattress- For extra heat during procedures especially extreme preterm and low birth weight infants.
- Skin temperature regulation- Skin temperature monitors can be used.

Staff should receive adequate training prior to use.

Please note- Do not tape anything to any metal parts of the Babyleo incubator as this can affect the working of the incubator.

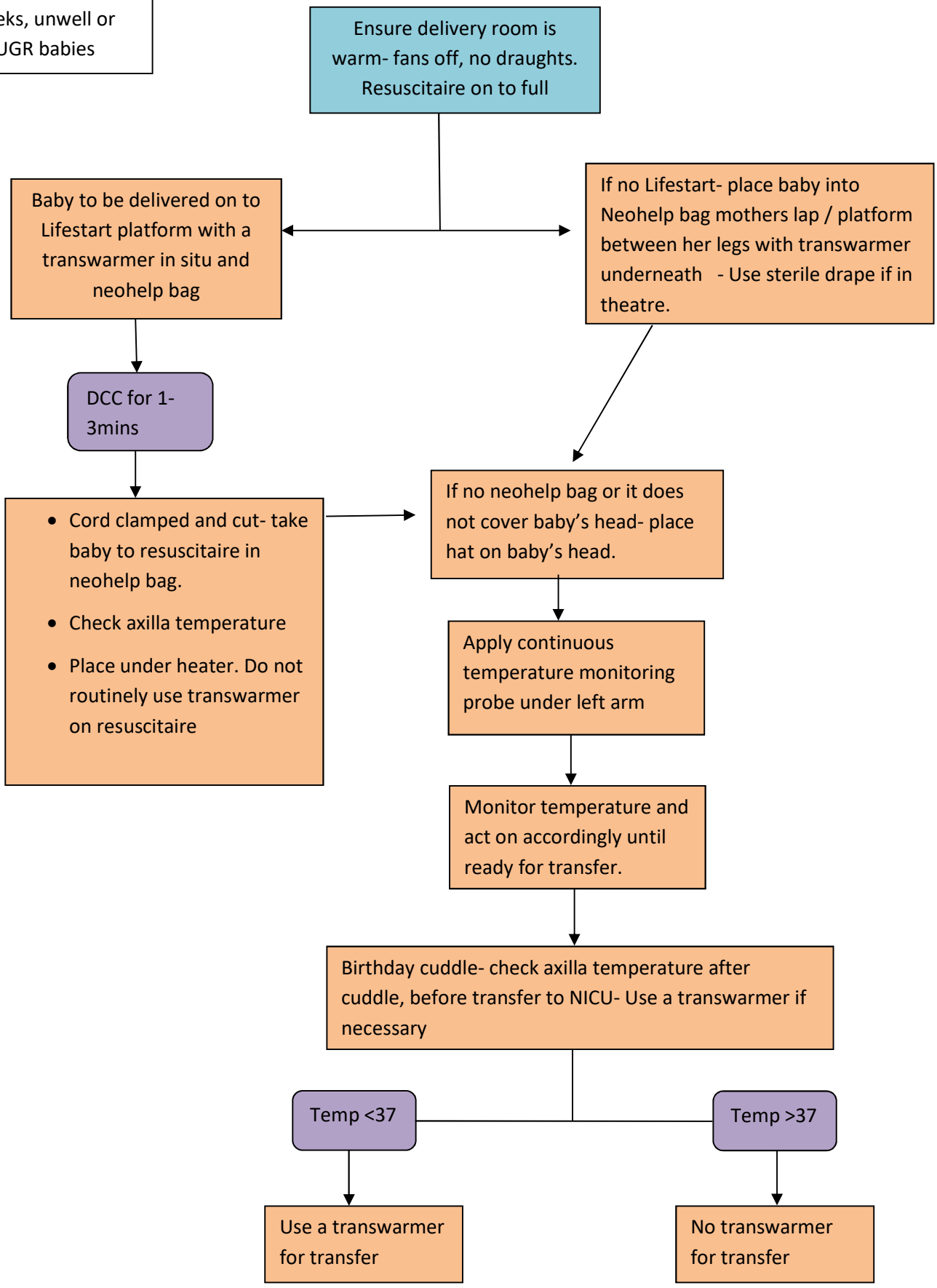
Appendix 2a

Temperature stabilisation >32 weeks and stable term infants



Temperature stabilisation <32 weeks, unwell or IUGR babies

Appendix 2b



3. Supporting References

Drager, (2020). Drager Babyleo. [Online] Available at: https://www.draeger.com/Products/Content/babyleo-tn500-pi-9102128-en-master-1908-1.pdf

McCall, E.M., Alderdice, F., Halliday, H.L., Jenkins, J.G. and Vohra, S. (2010) 'Interventions to prevent hypothermia at birth in preterm and/or low birthweight infants'. Cochrane Neonatal Group.

NHS Improvement. (2017). Reducing harm leading to avoidable admission of full-term babies into neonatal units. [Online] Available at: https://improvement.nhs.uk/documents/764/Reducing_term_admissions_final.pdf [Accessed 17/05/2020]

Royal College of Paediatrics and Child Health (2020). National Neonatal Audit Programme-your baby's information. [Online] Available at: https://www.rcpch.ac.uk/resources/national-neonatal-audit-programme-your-babys-information

4. Supporting relevant trust guidelines

Delayed cord clamping for <32 weeks gestation: SOP

http://trustnet/docsdata/paed/Guidelines_Neonatal/SOP%202%20Less%20than%2032%20Weeks%20DCC%20Jun%202019.pdf

5. Guideline Governance

a. Scope

This guideline in relevant to all staff caring for babies across neonatal intensive care, transitional care and maternity.

b. Purpose

i. This guidelines aims to facilitate a common approach to the management of babies admitted under neonatal care. At times deviation from the guideline may be necessary, this should be documented and is the responsibility of the attending consultant.

ii. This guideline is subject to regular review to ensure ongoing evidence based practice.

c. Duties and Responsibilities

What is expected from the health care professionals using this guideline to look after infants.

d. Approval and Ratification

This guideline will be approved and ratified by the Neonatal Guidelines Group.

e. Dissemination and Implementation

i. This guideline will be uploaded to the trust intranet 'Neonatal Guidelines' page and thus available for common use.
ii. This guideline will be shared as part of ongoing education within the Neonatal Unit for both medical and nursing staff.
iii. All members of staff are invited to attend and give comments on the guideline as part of the ratification process.

f. Review and Revision Arrangements

a. This policy will be reviewed on a 5 yearly basis.
b. If new information comes to light prior to the review date, an earlier review will be prompted.
c. Amendments to the document shall be clearly marked on the document control sheet and the updated version uploaded to the intranet. Minor amendments will be ratified through the Neonatal Guidelines Group. A minor amendment would consist of no major change in process, and includes but is not limited to, amendments to documents within the appendices.

g. Equality Impact Assessment

Background • Who was involved in the Equality Impact Assessment
Neonatal guidelines group
Methodology • A brief account of how the likely effects of the policy was assessed (to include race and ethnic origin, disability, gender, culture, religion or belief, sexual orientation, age) • The data sources and any other information used • The consultation that was carried out (who, why and how?)
All staff and patient populations were taken into account
Key Findings • Describe the results of the assessment • Identify if there is adverse or a potentially adverse impacts for any equalities groups
No evidence of discrimination
Conclusion • Provide a summary of the overall conclusions
No evidence of discrimination
Recommendations • State recommended changes to the proposed policy as a result of the impact assessment • Where it has not been possible to amend the policy, provide the detail of any actions that have been identified • Describe the plans for reviewing the assessment
Policy suitable for implementation, reviewed in 3 years

h. Document Checklist

To be completed (electronically) and attached to any document which guides practice when submitted to the appropriate committee for approval or ratification.

Title of the document:
Policy (document) Author:
Executive Director:

		Yes/No/ Unsure/NA	Comments
1.	**Title**		
	Is the title clear and unambiguous?	**Y**	
	Is it clear whether the document is a guideline, policy, protocol or standard?	**Y**	
2.	**Scope/Purpose**		
	Is the target population clear and unambiguous?	**Y**	
	Is the purpose of the document clear?	**Y**	
	Are the intended outcomes described?	**Y**	
	Are the statements clear and unambiguous?	**Y**	
3.	**Development Process**		
	Is there evidence of engagement with stakeholders and users?	**Y**	
	Who was engaged in a review of the document (list committees/ individuals)?	**Y**	
	Has the policy template been followed (i.e. is the format correct)?	**Y**	
4.	**Evidence Base**		
	Is the type of evidence to support the document identified explicitly?	**Y**	
	Are local/organisational supporting documents referenced?	**Y**	
5.	**Approval**		
	Does the document identify which committee/group will approve/ratify it?	**Y**	
	If appropriate, have the joint human resources/staff side committee (or equivalent) approved the document?	**NA**	
6.	**Dissemination and Implementation**		
	Is there an outline/plan to identify how this will be done?	**Y**	Theme of the week, simulation
	Does the plan include the necessary training/support to ensure compliance?	**Y**	
7.	**Process for Monitoring Compliance**		
	Are there measurable standards or KPIs to support monitoring compliance of the document?	**Y**	NNAP benchmarking
8.	**Review Date**		
	Is the review date identified and is this acceptable?		

		Yes/No/ Unsure/NA	Comments
9.	**Overall Responsibility for the Document**		
	Is it clear who will be responsible for coordinating the dissemination, implementation and review of the documentation?	**Y**	
10.	**Equality Impact Assessment (EIA)**		
	Has a suitable EIA been completed?		

Committee Approval (Neonatal Guidelines Committee)			
If the committee is happy to approve this document, please complete the section below, date it and return it to the Policy (document) Owner			
Name of Chair	**M. S. Edwards**	**Date**	**April 2021**
Ratification by Management Executive (if appropriate)			
If the Management Executive is happy to ratify this document, please complete the date of ratification below and advise the Policy (document) Owner			
Date: n/a			