Thermoregulation of the newborn

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1.0 Introduction

The peripheral vasoconstrictor mechanisms of a newborn baby are unable to prevent the fall in core body temperature which occurs during the first hours after birth. It is therefore important for midwives to ensure that they employ measures to minimise heat loss at delivery.

WHO Classifications of core body temperature for newborns: -

- • Normal = 36.5-37.5ºC 36,37,38
- • Mild Hypothermia or Cold Stress = 36-36.4ºC – cause for concern
- • Moderate Hypothermia = 32-35.9ºC – danger, warm baby
- • Severe Hypothermia =<32ºC -Outlook grave, skilled care urgently needed

2.0 Objective

To ensure that infants are cared for in an environment which enables them to maintain their body temperature within the normal range.

To provide midwives with guidance on the prevention, identification and care of a baby at risk of or with hypothermia.

3.0 Scope

This guideline applies to all medical and midwifery staff working on the maternity unit and to midwifery staff in the community.

4.0 Main body of the document

4.1 Heat production

During pregnancy, maternal mechanisms maintain the intrauterine temperature. After birth, the newborn must adapt to their environment by the metabolic production of heat.

4.2 Mechanisms of heat loss

Neonates are prone to rapid heat loss and consequent hypothermia because of a high surface area to volume ratio, which is even higher in low-birth weight infants.

There are several mechanisms for heat loss:

- Radiation: loss of heat from the infant to the surrounding objects
- Evaporation: water loss from the skin's surface, this is dependent on three factors:
    - How wet the baby is with amniotic fluid?
    - How immature and water permeable the skin is
    - How much the infant is exposed to drying factors such as air movement
- A baby loses 540 calories for every one gram of water evaporated after birth
- Conduction: occurs when the heat transfers from one object to another such as when a baby is placed on a cool surface
- Convection: heat loss from the skin due to moving air- this is dependent on air speed and temperature

4.3 Clinical effects of cold

Cold stress affects oxygenation by increasing pulmonary artery resistance and reducing surfactant production. If the temperature drops below 35 ˚C, surfactant production decreases and its ability to act as a surface tension lowering agent is impaired.

Additionally, there is extra utilization of glucose because of the increased metabolism which can lead to hypoglycaemia.

Prolonged hypothermia with its resultant poor cardiac output and flow to the central nervous system also has an effect on the intestinal blood flow and may predispose to necrotising enterocolitis.

4.4 Normal temperature

The normal temperature for a healthy infant is between 36.5˚C-37.5˚C.

4.5 Risk factors for hypothermia

Babies who:

- Have required resuscitation
- Are low birth weight
- Are less than 37 completed weeks gestation
- Are delivered by Caesarean Section
- Have experienced respiratory distress

4.5.1 Signs of Hypothermia

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

4.6 Management to prevent heat loss at birth

To prevent heat loss in healthy term infants:

- The ideal temperature of the delivery room for second stage is 26˚C.
- Ensure the resuscitaire is switched on well in advance of delivery and provide pre-warmed towels and blankets
- Ensure all windows in delivery rooms are closed and fans off to avoid draught
- Ensure the baby is thoroughly dried following delivery to prevent heat loss by evaporation

- Remove the wet towel
- During delayed cord clamping, dry the baby and cover the baby.
- A hat should be placed on the baby's head, and the baby should be covered in warm towels while maintaining skin contact with the mother
- Encourage skin to skin contact with the mother for a minimum of one hour, at least until after the first feed (or as long as the mother wishes) to promote heat gain and to ensure feeding gets off to the best start
- Ensure that the woman is not hypothermic

For babies at risk of getting cold e.g. Small for gestational Age (SGA) babies, or those whose mothers are unable to perform skin to skin, e.g. in theatre if the woman has had a general anaesthetic; a heated mattress (stored on the Birthing Centre), should be used to maintain the baby's temperature. The baby's initial temperature should be above 36.0˚c. Babies with a temperature below 36.0°C should be managed as per instructions in section 4.7.

- The temperature of the heated mattress should be set at 37 ˚c
- The heated mattress should be covered with one sheet and the baby placed in dressed and covered with one sheet and one blanket
- The heated mattress should not be used for long periods of time
- If a baby's temperature is less than 36.0 ˚c follow the instructions below for the treatment of hypothermia

All babies in the first two hours after birth should have their observations performed in line with the RAPPT (Respirations, Activity, Perfusion, Position/Tone and Temperature) tool.

4.6.1 Infants requiring resuscitation:

- If the baby requires resuscitation, place on heated towels under a radiant heater and assess the infant's condition
- If completing a prolonged resuscitation or when the resuscitaire automatically reduces heat from the full bars to three bars manually increase this back to full

4.6.2 Preterm infants:

- If the baby is less than 32 completed week's gestation, then put the baby in a plastic bag with the head exposed. The baby should be tucked in so it won't be exposed to any draught. This is to avoid the baby drying and to help maintain the temperature.
- Consider the ability for the mother to have time with the baby if suitable

4.7 Measurement of temperature

- Intermittent temperature recording taken from the axilla is the recommended way to monitor temperature.
- This should be taken using the covidien thermometer. A single use sheath system is to be used.

- For babies who require observations because they are high risk of complications for example Pre-labour rupture of membranes (PROM) or Group B Streptococcus (GBS) the Guideline for Newborn Early Warning Track and Trigger (NEWTT) should be followed for frequency of observations.
- If the infant is having observations just because he/she is hypothermic, these should be completed hourly if the temperature is below 36.5 ˚C. Once the temperature is within normal limits (36.5 ˚C or above) the temperature should be re-checked after one hour and then discontinued.
- When the baby has had two consecutive normal temperature readings (36.5 ˚C or above) discontinue monitoring.
- If the temperature is not increasing or is decreasing, complete temperature checks more frequently.

4.8 Treatment of an infant with hypothermia

There is no increase in mortality between infants re-warmed slowly or quickly.

4.8.1 For an axilla temperatures measuring below 36.5 ˚C but above 36 ˚C complete the following:

- If the mother is able to provide skin to skin contact with the baby this is the first line management. The baby should be dressed just in a nappy and hat and positioned against the mother's skin with both of them covered with blankets. For skin to skin to be effective, the mother should not be hypothermic, so prior to skin to skin commencing check maternal temperature to confirm this. Alternatively, the baby can be placed on a heated mattress (stored on the Birthing Centre), if skin to skin is not possible. If the baby has not fed, encourage feeding. If baby not interested in breast/chest-feeding encourage the mother to hand express small amounts of colostrum into baby's mouth, (alternatively, if available use harvested colostrum, if used encourage hand expressing to increase milk supply).
- Repeat the temperature one hour from commencing skin to skin. If the temperature is above 36.5 ˚C skin to skin can continue until the mother wishes to stop. The infant's temperature should then be checked one hour from being dressed to ensure the temperature has maintained.
- If the temperature has increased, but remains below 36.5 ˚C, continue with skin to skin/heated mattress (stored on the Birthing Centre), for one further hour. After this hour if the infant's temperature is above 36.5 ˚C discontinue skin to skin and follow the management as above.
- If the temperature of the baby has not increased following this further hour of skin to skin/heated mattress (stored on the Birthing Centre), the baby should be nursed in a pre-warmed incubator and referred to paediatricians for review.

4.8.2 For an axilla temperature below 36 ˚C complete the following:

- Prepare incubator- set temperature to 33 ˚C

- Put the baby in the pre-warmed incubator in a well-fitting hat and nappy
- If a pre-warmed incubator is not available keep the baby under the heater on the resuscitaire until one is ready
- Perform hourly measurements of axilla temperature until the temperature is above 36.5˚C
- If there are no improvements after one hour, increase the incubator temperature by 1.0 ˚C per hour to a maximum of 35.0 ˚C
- Once the temperature is above 36.5 ˚C, monitor two hourly and reduce the incubator temperature by 1.0 ˚c every 2 hours. The baby should be dressed and left in the incubator as the incubator temperature is decreased. Use your clinical judgment, if unsure contact the neonatal unit for advice
- Once the incubator temperature is down to 30.0 ˚C and the infant's temperature has remained over 36.5 ˚C on two consecutive occasions, the baby should be removed from the incubator, wrapped well and placed in a normal cot
- The incubator should not be switched off in case the baby drops their temperature again
- The baby must be referred to a paediatrician if the temperature does not rise above 36.4 ˚C
- Document all observations on the NEWTT chart
- Ensure 2-3 hourly feeds

Infants who become hypothermic are at increased risk of hypoglycaemia. If the temperature is <35.0 ˚C on one occasion, a blood glucose reading should be considered especially if the baby does not respond to normal warming measures; is ineffectively feeding (encourage hand expressing and drop colostrum into baby's mouth or use harvested colostrum if available) or is otherwise symptomatic of hypoglycaemia. If the temperature is persistently <36.0 ˚C despite warming, a blood glucose reading should be considered.

4.9 Signs of Hyperthermia due to overheating.

- Tachycardia, tachypnoea, apnoea
- Hypotension Page 5 of 27
- Warm extremities, flushing, perspiration
- Lethargy, hypotonia, ineffective feeding
- Central temperature lower that peripheral temperature

4.9.1 Signs of hyperthermia due to fever.

- Pale, cool extremities
- Core temperature greater than peripheral temperature

5.0 Associated documents and references

- East of England Neonatal ODN (2022) Clinical Guideline: Thermoregulation Guideline for Surfactant Administration (eoeneonatalpccsicnetwork.nhs.uk)
- Great Ormond Street Hospital: Guideline for Thermoregulation in neonates (2017) [online] www.gosh.nhs.uk
- Parke, K (2017). Clinical guideline. Guideline for prevention and management of hypothermia in the newborn
- Parsons, H (2017). Clinical guideline: Thermoregulation for neonates. [Online] https://www.gosh.nhs.uk/health-professionals/clinical-guidelines/thermoregulationneonates
- Pilgrim, S (2019). Clinical guideline. Prevention and management of neonatal hypothermia
- Resuscitation Council (UK) (2021). Resuscitation and support of transition of babies at birth [online] Newborn resuscitation and support of transition of infants at birth Guidelines | Resuscitation Council UK
- Stavis, R (2017). Clinical guideline. Hypothermia in neonates
- Waldron, S. and MacKinnon, R. (2007). Neonatal thermoregulation. Infant, 3(3), pp.101-104.

6.0 Training and resources

Training will be given as documented in the Maternity Training Needs Analysis. This is updated on an annual basis.

7.0 Monitoring and audit

Any adverse incidents relating to thermoregulation in the newborn will be monitored via the incident reporting system. Any problems will be actioned via the case review and root cause analysis action plans. The action plans are monitored by the risk midwife to ensure that improvements in care are made. The trends and any root cause analysis are discussed at the monthly risk meetings to ensure that appropriate action has been taken to maintain safety.

The guideline for Thermoregulation of the newborn will be audited in line with the annual audit programme, as agreed by the CBU. The audit action plan will be reviewed at the monthly risk management meetings on a quarterly basis and monitored by the risk midwife to ensure that improvements in care are made.

8.0 Equality and Diversity

The Trust is committed to an environment that promotes equality and embraces diversity in its performance as an employer and service provider. It will adhere to legal and performance requirements and will mainstream equality, diversity and inclusion principles through its policies, procedures and processes. This guideline should be implemented with due regard to this commitment.

To ensure that the implementation of this guideline does not have an adverse impact in response to the requirements of the Equality Act 2010 this policy has been screened for relevance during the policy development process and a full equality impact assessment is conducted where necessary prior to consultation. The Trust will take remedial action when necessary to address any unexpected or unwarranted disparities and monitor practice to ensure that this policy is fairly implemented.

This guideline can be made available in alternative formats on request including large print, Braille, moon, audio, and different languages. To arrange this please refer to the Trust translation and interpretation policy in the first instance.

The Trust will endeavor to make reasonable adjustments to accommodate any employee/patient with particular equality, diversity and inclusion requirements in implementing this guideline This may include accessibility of meeting/appointment venues, providing translation, arranging an interpreter to attend appointments/meetings, extending policy timeframes to enable translation to be undertaken, or assistance with formulating any written statements.

8.1 Recording and Monitoring of Equality & Diversity

The Trust understands the business case for equality, diversity and inclusion and will make sure that this is translated into practice. Accordingly, all guidelines will be monitored to ensure their effectiveness.

Monitoring information will be collated, analysed and published on an annual basis as part of Equality Delivery System. The monitoring will cover the nine protected characteristics and will meet statutory employment duties under the Equality Act 2010. Where adverse impact is identified through the monitoring process the Trust will investigate and take corrective action to mitigate and prevent any negative impact.

Appendix 1
Glossary of terms

GBS- Group B Streptococcus

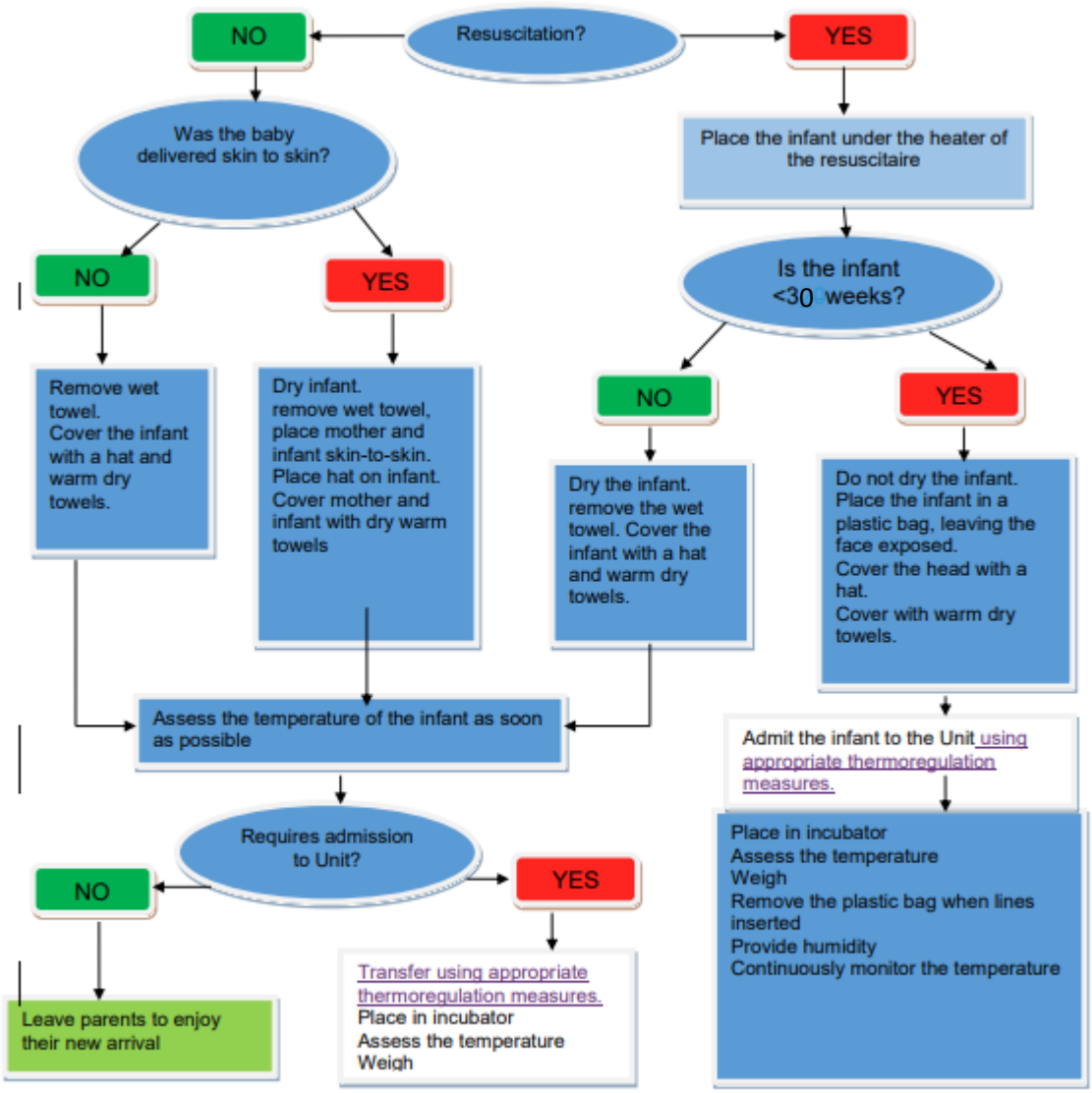
NEWTT – Newborn early warning trigger and track

PROM – Pre-labour rupture of the membranes

RAPPT - Respirations, Activity, Perfusion, Position/Tone and Temperature

SGA – Small for gestational age

Appendix 2 Thermoregulation at Birth diagram.



Taken from the East of England Thermoregulation ODN guidance

Appendix 3

Version	Date	Comments	Author
1	31/07/2019		Maternity guideline group
2			Maternity guideline group
3			Maternity guideline group
4	02/12/2020		Quality Safety and Governance Manager
5			

Review Process Prior to Ratification:

Name of Group/Department/Committee	Date