Joint Trust Guideline for the Management of Babies with Severe Umbilical Artery Acidosis (Cord Arterial pH≤7.1)

For Use in:	Neonatal Intensive Care Unit, Delivery suite and Blakeney ward
By:	Registered neonatal medical and registered nursing staff, registered midwives
For:	Neonates
Division responsible for document:	Women and Children's Division
Key words:	Cord arterial pH, Cerebral function monitor, Total body Hypothermia, Hypoxic Ischaemic Encephalopathy (HIE)
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Compliance links: *(is there any NICE related to guidance)*	Intrapartum care. Care of healthy women and their babies during childbirth. National Collaborating Centre for Women's and Children's Health.
If Yes - does the strategy/policy deviate from the recommendations of NICE? If so why?	No deviations stated.

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Version and Document Control:

Version Number	Date of Update	Change Description	Author
3	10/06/2022	Paragraph added to cover action to take if the umbilical cord lactate level was abnormal. Paragraph added regarding Paired samples	Rahul Roy and Susan Holland

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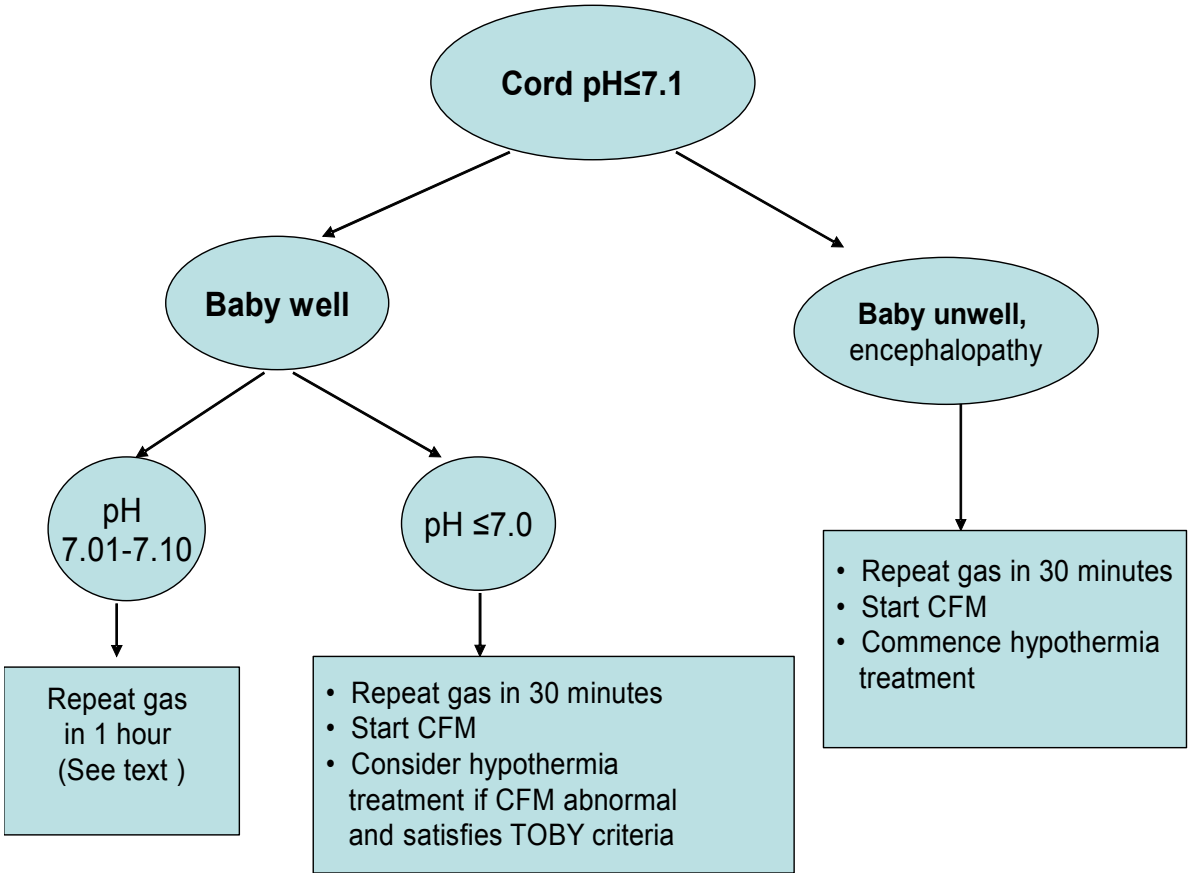
Quick Reference Guide

Algorithm for management of babies with low cord pH



Glossary

HIE	Hypoxic Ischaemic Encephalopathy
SpR	Specialist registrar
ANNP	Advanced neonatal nurse practitioner
CFM	Cerebral function monitoring
TOBY	Total Body hypothermia
NICU	Neonatal intensive care unit

1) Objective of Guideline

To provide guidance for the management of babies with a severe umbilical cord acidosis (arterial pH).

2) Rationale for the recommendations

Umbilical cord blood gas analysis is recommended by NICE whenever there has been a concern about the baby either in labour or immediately following birth.[1] The baby born with a low cord pH and/or in a poor condition may have suffered a significant perinatal hypoxic insult. There are multiple risk factors for fetal acidosis as below.

Risk factors for fetal acidosis

- Prolonged labour/prolonged 2nd stage.
- Uterine hyperstimulation.
- Twin pregnancy labour.
- Spinal and general anaesthesia.
- Placental abruption/ antepartum haemorrhage.
- Placental infarction.
- Chorioamnionitis.
- True knots/acute cord compression.

The generally accepted cut off value for a pathological acidosis (risk of seizures, moderate to severe HIE and cerebral palsy) is umbilical arterial pH ≤ 7.0. [2,3] It is unlikely that acute acidosis with a pH value greater than 7.0 is directly associated with cerebral palsy.[4] An audit performed in NICU (March 2007-Febuary 2010) showed that 95% of babies with a pH < 7.0 had a significant mixed or metabolic acidosis and 34% of these babies developed moderate to severe Hypoxic Ischaemic Encephalopathy (HIE) In babies with a cord pH between 7.0-7.1, pure respiratory acidosis was found in 42% babies while a metabolic or mixed acidosis occurred in 58% of babies.[5] Both the groups are at high risk of problems in the early neonatal period, such as: respiratory distress needing support, poor feeding, hypoglycaemia, and seizures. It is important that these babies are monitored closely in accordance with recommendations described below, so that treatment with total body hypothermia can be instituted early.

Paired arterial and venous cord blood samples should be analysed by the obstetric team in all high-risk deliveries. Any cord pH ≤ 7.1 should be recorded as a critical incident and be reported by the obstetric team to the NICU team immediately.

Paired samples

If only a single sample is obtained there is no way of knowing if it is arterial or venous, so it is important to obtained paired samples whenever possible. If only one sample is obtained, the midwife must ensure that both the obstetric and neonatal medical or nurse practitioner teams are aware there is only one result.

3) Recommendations

3.1 Any infant with a cord pH ≤ 7.0(arterial or venous) and the infant appears well

Action

- The baby should be reviewed by a SpR/ANNP and admitted to the NICU.
- A repeat blood gas should be performed ideally within 30 minutes of birth but certainly within 60 minutes. If capillary pH< 7.25, perform an arterial blood gas.
- Cerebral function monitoring (CFM) should be commenced in all cases, and if abnormal should be discussed with a consultant as soon as possible.

- Commence total body hypothermia for neuroprotection in babies with abnormal neurological signs. *(See TOBY guideline). A quick reference guide pertaining to eligibility for hypothermia treatment is given below.
- If the baby does not meet criteria for cooling, she/he needs to be monitored in NICU for at least 24 hours for seizures, feeding difficulties and hypoglycaemia. Neonatal Hypoglycaemia (Trustdocs ID: 1196).
- A formal neonatal review must be performed by a neonatal SHO/SpR/ANNP at 24 hours and prior to discharge to the postnatal ward.

Eligibility for total body hypothermia (TOBY) requires two sets of criteria to be satisfied (A and B).

A. Infants ≥ 36 weeks gestation admitted to the NICU with at least ONE of the following

- Apgar score of ≤5 at 10 minutes after birth.
- Continued need for resuscitation, including endotracheal or mask ventilation, at 10 minutes after birth.
- Acidosis within 60 minutes of birth (defined as any occurrence of umbilical cord, arterial or capillary pH <7.00)
- Base deficit ≥16mmol/L in any blood sample (arterial, venous or capillary) within 60 minutes of birth.

Infants that meet criteria A will be assessed as to whether they meet **criteria B**

Moderate to severe encephalopathy, consisting of (all THREE):

- Altered state of **consciousness** (lethargy, stupor or coma) with reduced/absent response to stimulation.

AND

- Abnormal **tone** (focal or general hypotonia, or flaccidity).

AND

- Abnormal **reflexes** (absent/weak suck or Moro response, abnormal pupils).

OR

Seizures

* http://bebop.nhs.uk/healthcare-professionals/identification/identifying-who-to-cool/

3.2 Any infant with cord pH 7.01-7.1(arterial or venous) and the infant appears well

Action:

- A capillary blood gas should be done within 1 hour following delivery.
- If the pH has not normalised (i.e., pH <7.25) then an arterial gas should be performed. If the arterial pH is still <7.25 then the baby should be admitted to the neonatal unit for observation for a minimum period of 24 hrs.
- If the pH has normalised (i.e., pH ≥7.25) and the baby is clinically well then he/she can be discharged back to postnatal ward.

- The baby needs to be monitored by the midwifery team for: abnormal movements, feeding difficulties and hypoglycaemia (see hypoglycaemia guideline). An early first feed, and regular feeding (at least 3 hourly thereafter) should be offered to the baby. A feeding chart should be maintained by the midwife for 24 hours.
- Neonatal review must be performed by a neonatal doctor/ANNP at 12 hours, 24 hours and also prior to discharge or earlier if there are any concerns.

3.3 Any infant with a cord pH ≤ 7.1 (arterial or venous) and the infant appears unwell with respiratory distress or has features of neonatal encephalopathy

Action:

- The baby should be immediately admitted to NICU.
- A blood gas should be done within 30 minutes of birth.
- Babies should be monitored for respiratory distress, renal and liver function, hypoglycaemia, coagulopathy, hypotension and abnormal movements.
- Consider sepsis and metabolic conditions as possible causes of the poor condition at birth.
- CFM monitoring should be done in all cases.
- Commence total body cooling for neuroprotection in babies with abnormal neurological features (see separate TOBY guideline).
- Inform the consultant in all cases.

Umbilical cord lactate interpretation

Raised umbilical cord lactate is commonly seen in neonates following perinatal hypoxia, however, there is not a strong correlation between the level to which the lactate is raised and neonatal outcome. There is evidence though that time to normalisation correlates with degree of hypoxic brain injury and with seizure burden.

Lactate result can be affected by multiple factors including gestation, timing of sample and mode of delivery. Lactic acidosis can be caused by other conditions in addition to hypoxia such as inborn errors of metabolism, systemic infection and hypoperfusion.

With this in mind, if the cord blood lactate is raised (normal cord lactate is 1.5-4.5 mmol/L, Roberton's Textbook of Neonatology) the baby should be carefully assessed with consideration given to the full history. The lactate result should be used in conjunction with other blood results and observations, along with clinical examination to inform decision making. Clear plan should be made and documented in the neonatal notes detailing need for any additional observations and/or repeat blood lactate sample (and timing). The lactate level should be repeated until a normal value is seen. All infants with raised cord lactate should be discussed with a Tier 2 doctor or ANNP.

4) Clinical Audit Standards Derived from Guideline

- All infants with a cord pH ≤7.0 should have a repeat gas within 30 minutes of birth.
- All infants with a cord pH 7.01 -7.10 should have a repeat gas within 1 hour of birth.
- All infants with a pH ≤ 7.0 should have cerebral function monitoring.

- All infants with a pH ≤ 7.0 should have a documented neurological examination at admission to NICU.
- All infants with a pH ≤ 7.1 should have a documented review at discharge from the NICU or postnatal ward.

5) Summary of the development and consultation process undertaken before registration and dissemination

This guideline was drafted by the authors listed above on behalf of the NICU and discussed in the NICU audit meeting on 11/08/2010, and the clinical governance meeting on 20/08/2010, which was attended by consultant obstetricians and neonatologists and other medical and nursing staff. Further modifications were made based on the suggestions received at the unit guideline meeting before submission to the guideline assessment panel**.**

Feb 2017 Dr R Roy reviewed, and minor changes were needed to comply with the cooling criteria. In 2020 a paragraph added to cover action to take if the umbilical cord lactate level was abnormal. A further paragraph added regarding Paired samples

6) Distribution list/ dissemination method

a. Hospital intranet.
b. Neonatal Unit.

7) References

1. Intrapartum care. Care of healthy women and their babies during childbirth. National Collaborating Centre for Women's and Children's Health. Commissioned by the National Institute for Health and Clinical Excellence. RCOG Press, 2007.
2. Van den Berg *et a*l. Neonatal complications in newborns with an umbilical artery pH < 7.00 Am J Obstet Gynecol. 1996;175:1152-7
3. Gemma L Malin, Rachel K Morris, Khalid S Khan, Strength of association between umbilical cord pH and perinatal and long term outcomes: systematic review and meta-analysis BMJ 2010; 340:c1471.
4. Blickstein I,Green T. Umbilical cord blood gases. Clin Perinatol 2007;34:451-9
5. Shastri AT, Chalia M, Karim D, Roy R. Complications in near term and term babies with severe umbilical artery acidaemia. *Pediatric Research* 2010;Nov (Supp1):960

7.1 Source Documents

Trust Guideline for the Management of Hypoglycaemia in Preterm Infants Neonatal Hypoglycaemia (Trustdocs ID: 1196).