Barnsley Hospital NHS
NHS Foundation Trust

Title	**Prevention and management of Hypoglycaemia of the newborn. Including impaired metabolic adaptation and management of reluctant feeding in healthy term infants more than 37 weeks gestation.**	
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Table of Contents

1.0 Introduction

This guideline refers to babies at risk of impaired metabolic adaptation and hypoglycaemia who are deemed well enough to be cared for on the postnatal ward.

Healthy term babies often feed infrequently in the first 24–48 hours after birth. Additionally, normal healthy term babies may have low blood glucose in the first two to three days and are protected by a ketone body response. It is unlikely that they will suffer any ill effects unless feed insufficiency is prolonged and routine blood glucose monitoring is not appropriate for these babies.

However, babies with additional risk factors are less able to mount this response. Babies who are at risk need to be correctly identified and managed appropriately.

For all breastfed babies the aim should be to ensure that needs are met as far as possible by breastfeeding, or by the use of expressed colostrum / breast milk (EBM). Exclusive breastfeeding enhances the baby's ability to mobilise energy stores (counter- regulate) whereas large volumes of infant formula suppress this ability.

For formula fed babies the aim should be to ensure frequent effective feeding and ongoing observation of the baby's condition, this is vital as ineffective feeding may be a sign of illness.

Blood glucose measurements taken prior to two hours of age are not informative as readings made immediately after birth is merely indicative of the mother's blood glucose concentration. Levels may drop sharply until counter regulation is initiated.

If blood glucose levels remain lower than the acceptable minimum (Appendices 3-6), the baby should be reviewed by a paediatrician with a view to further investigation and appropriate management to rule out hyperinsulinism or any another metabolic disorder characterised by neonatal hypoglycaemia.

Hyperinsulinism should be considered if the blood glucose concentration remains low (<2mmol/l) on three or more occasions in the first 24 hours despite adequate energy provision and feeding plan, or if a glucose dose more than 8mg/kg/min is required.

If at any time the baby has abnormal clinical signs there should be immediate review by a paediatrician.

2.0 Objective

The aim of this guideline is to:

- Identify those infants at risk of impaired metabolic adaptation and hypoglycaemia and ensure timely intervention and treatment
- Prevent harm caused by unrecognised or untreated hypoglycaemia
- Minimise unnecessary interventions and admissions to the Neonatal Unit

3.0 Scope

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

4.0 Main body of the document

4.1 Management of infants at risk of Impaired Metabolic Adaptation and Hypoglycaemia

Infants with the following risk factors are at risk of neurological sequelae of neonatal hypoglycaemia and require blood glucose monitoring

Maternal conditions:

- Diabetes
- Maternal use of beta blockers (e.g. Labetalol)

Neonatal conditions:

- Intrauterine Growth Restriction/Small for Gestational Age or Low Birth Weight (i.e.) below the 2nd centile on the gestational age and sex specific chart (Appendix 1) or infants that are clinically wasted (infants that are clinically wasted appear starved with loose wrinkled skin, dry peeling skin, little muscle especially on the upper legs and a reduced abdominal circumference with normal head circumference and femur length)
- Preterm babies (<37 weeks gestation)
- Syndromes:
    - Midline defects
    - Beckwith- Wiedemann
    - Turner syndrome
    - Costello syndrome
    - Prader-Willi syndrome
    - Sotos syndrome
- Metabolic disorders

Blood glucose levels should also be monitored on any infant with one or more of the following clinical signs:

- Perinatal acidosis (cord arterial or infant pH <7.1 and a base deficit
- ≥12mmo/l)
- Hypothermia (<36.5°C) not attributable to environmental factors
- Suspected/confirmed early onset sepsis
- Apnoea
- Cyanosis
- Seizures
- Lethargy
- Hypotonia
- High pitched cry
- Abnormal feeding behaviour (especially after a period of feeding well):
    - Not waking for feeds
    - Not sucking effectively
    - Appearing unsettled and demanding very frequent feeds

NB – Jitteriness defined as excessive repetitive movements of one or more limbs which are unprovoked and not in response to stimulus is common and by itself is not an indication to measure blood glucose

NB - Babies who are developing hypoglycaemia may be asymptomatic.

The above signs are not specific to hypoglycaemia and may be an indication of another underlying cause of illness such as infection.

4.2 Measuring blood glucose levels in infants

As a gold standard blood glucose levels should be measured using a ward based blood gas analyser. This will provide an immediate and accurate blood glucose estimation prompting timely management.

Hand held blood glucose analysers are not accurate at a range of 0 - 2.0mmol/l and have a possible error of +/- 0.8mmol/l for values <5.5mmol/l.

A hand held blood glucose analyser can be used in the first instance, however if the result is <2.8mmol/l a measurement should be taken using a ward based blood gas analyser.

Samples should be taken from a warm, well perfused heel by heel-prick or from a free flowing venous/arterial sample following Trust guidelines for skin asepsis. Air bubbles in the capillary tubes should be avoided.

4.3 Care at birth

Commence the care pathway for term infants at risk of hypoglycaemia (Flow chart A – appendix 2)

- Mothers are encouraged to have skin to skin contact to promote warmth and initiate feeding. The baby will be dried and a hat put on.
- Ensure that the ambient temperature in the room is warm.
- Breastfeeding should be encouraged for babies who are at risk of hypoglycaemia as colostrum and breast milk contain metabolites which are thought to help babies cope with the physiological drop in blood glucose following birth.
- Babies will be encouraged to feed as soon as possible within one hour of birth (NB. babies who are at risk of hypoglycaemia may not display normal feeding cues).
- If the woman chooses not to breast feed, the infant should be given a formula feed (10-15ml/kg) within the first hour.
- Assess and document feeding cues and feeding effectiveness.
- Commence a NEWTT chart and record clinical observations; review baby and manage clinical concerns promptly.
- Babies at risk of hypoglycaemia will require systematic assessment of wellbeing using the NEWTT chart and escalation guidance outlined in the Guideline for the use of the Newborn Early Warning Trigger and Track system.

Refer for paediatric review if any deviation from normal and document findings in Baby Records.

4.4 Care irrespective of feeding method:

- Continue to encourage skin to skin contact.
- The baby's first blood glucose will be evaluated prior to the second feed (two to four hours after birth).
- Offer feeds in response to feeding cues but do not allow more than three hours to pass between feeds.
- Continue until blood glucose measurements have been ≥ 2mmol/l on two consecutive occasions on a blood gas analyser **or** ≥ 2.8mmol/l if measured on a hand held blood glucose analyser.
- If the result of blood glucose is <2.8mmol/l on a hand held blood glucose analyser then blood glucose should be measured using a blood gas analyser. Ideally subsequent samples should be measured using a blood gas analyser; however, a hand held blood glucose meter can be used if a delay in getting the result is anticipated

Based on the result of the first blood glucose measurement place the baby on one of the following pathways:

- **Flow chart A (Appendix 2)** if the first pre-feed blood glucose is ≥2.0mmol/l
- **Flowchart B (Appendix 3)** if the first pre-feed blood glucose is 1.0- 1.9mmol/l and there are no abnormal signs
- **Flowchart C (Appendix 4)** if the first pre-feed blood glucose is < 1.0mmol/l, and or clinical signs consistent with hypoglycaemia.
- Document all care, observations and blood glucose levels in the postnatal booklet and on the NEWTT chart

4.5 Administration of Buccal dextrose gel

Buccal dextrose can be used as a first line treatment to manage hypoglycaemia in the first 48 hours but must be used in conjunction with a feeding plan to enable the establishment of normal feeds.

Can be used within the first 48hrs after birth for infants ≥ 35weeks gestation who with a blood glucose of 1.0-1.9mmol/l and no other clinical signs.

Up to six doses can be given over a 48hr period but infants requiring more than one dose should be discussed with the paediatrician. Infants requiring three or more doses will require a paediatric review.

For infants with a blood glucose level <1.0mmol/l buccal dextrose should only be used whilst arranging urgent medical review and treatment with IV glucose.

See **Appendix 7** for guidance on the administration of buccal dextrose gel.

Do not discharge infants who are at risk of hypoglycaemia:

- Before 24hrs of age

- Until the infant has had blood glucose measurement of ≥ 2mmol/l (measured using blood gas analyser) or ≥2.8mmol/l (measured using hand held blood glucose analyser) on two consecutive occasions and is feeding well.

4.6 Management of breastfed babies

- Offer the breast in response to feeding cues as often as possible
- If the infant is not showing signs of effective feeding:
    - Encourage continuous skin to skin and teach the mother to hand express
    - Give the EBM to the infant immediately by 1ml syringe, cup or directly into baby's mouth.
    - Encourage the mother to express eight to ten times in 24 hours until the infant is feeding effectively

- Frequent small volumes of colostrum will be easily digested and absorbed by the baby
- Do not allow more than three hours to pass between feeds
- Supplementary feeding may be required if the mother cannot produce sufficient colostrum to achieve an acceptable rise in the infant's blood glucose levels. This should only be given following discussion with the mother. Parents will be made aware of clinical indications when supplementation of formula is required and explanations documented.
- Supplementation should be offered in an appropriate volume (10- 15ml/kg per feed) by cup until colostrum is available

4.7 Management of formula fed babies

- Mother will be supported with bottle feeding technique until they are confident
- Offer baby frequent feeds at least three hourly or more frequently if baby is showing signs of willingness to feed (NB formula fed babies have limited ability to utilize ketone bodies therefore frequent feeds of sufficient volume are needed to ensure that blood glucose levels remain acceptable)
- Offer 10 - 15ml/kg per feed

4.8 Information for parents

Parents should be given verbal and written information that describes:

- Why their baby requires extra support and blood glucose monitoring
- How to reduce the likelihood of hypoglycaemia
- Signs that their baby is becoming unwell
- How to raise concerns if they suspect their baby is unwell or not feeding

For written information see **Appendix 6.**

4.9 Management of infants with Impaired Metabolic Adaptation and Persistent Hypoglycaemia

Persistent or recurrent hypoglycaemia can be the first presentation of an underlying disorder of glucose metabolism. Early detection is important as investigations designed to reduce the risk of brain injury may be required
A newborn infant with the following will require urgent referral to a paediatrician:

- Two or more blood glucose measurements <2.0mmol/l within the first 48 hours
- A blood glucose measurement of < 1.0mmol/l irrespective of age
- Signs of acute neurological dysfunction and a blood glucose of<2.5mmol/l

The infant will require investigations for:

- Blood glucose; insulin, cortisol; growth hormone; fatty acids; ketone bodies; carnitine; acylcarnitine profile; amino acids; ammonia and lactate
- Urine ketones and organic acids
- Consider investigations for early onset sepsis

Transient hypoglycaemia (i.e.) one blood glucose level of 1.0 - 1.9mmol/l in the first 24 hours with no abnormal signs who is feeding effectively does not require the above investigations.

5.0 Associated documents and references

British Association of Perinatal Medicine (BAPM). Identification and Management of Neonatal Hypoglycaemia in the Full Term Infant – A Framework for Practice (2017) [online] www.bapm.org

6.0 Training and resources

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

7.0 Monitoring and audit

Any adverse incidents relating to (insert guideline subject) 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 (insert guideline name) 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 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

This section is mandatory for all Trust Approved Documents and must include the statement below:

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.

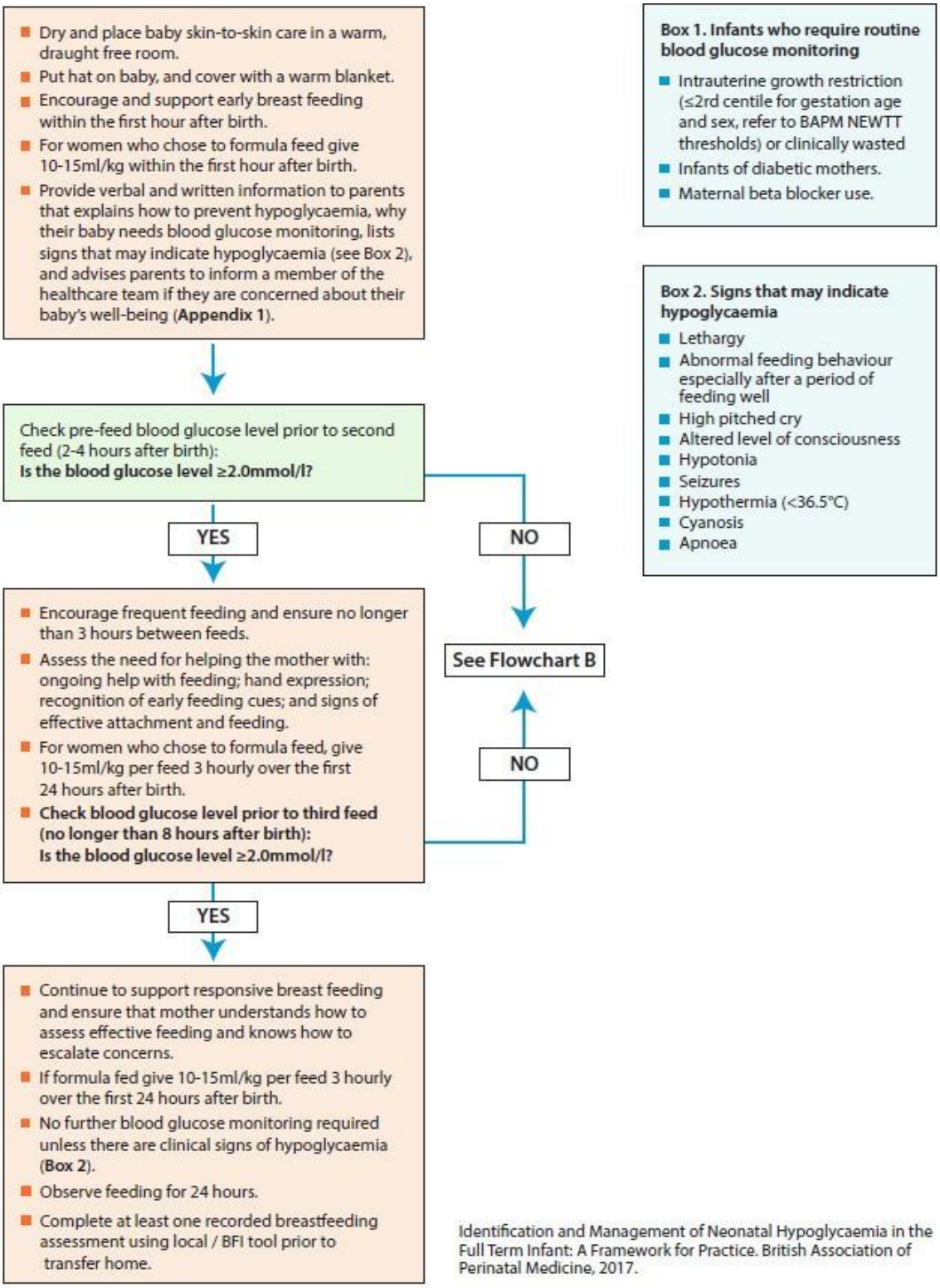
Appendix 1

Second centile Birth weights for boys and girls by week of gestation (BAPM)

Birth weight on 2nd centile/kg		
Gestational age/weeks	Boys	Girls
37	2.10	2.00
38	2.30	2.20
39	2.50	2.45
40	2.65	2.60
41	2.80	2.75
42	2.90	2.85

Appendix 2

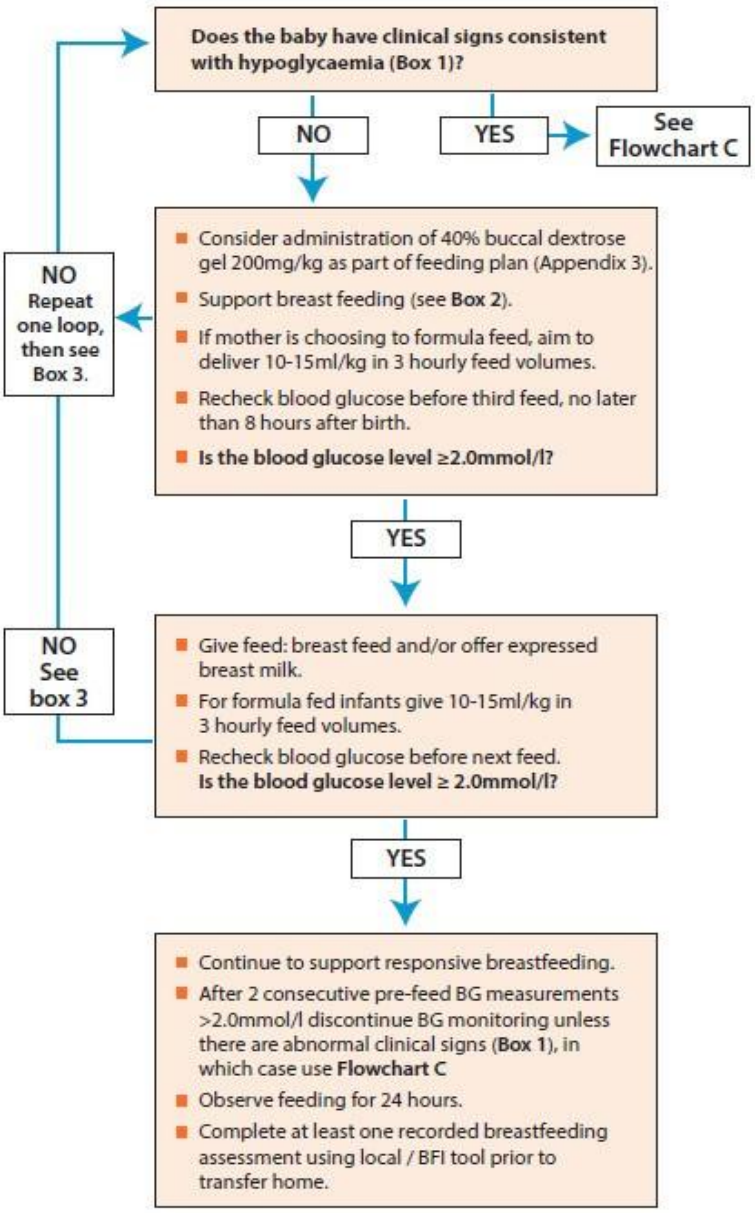
Flow chart A – Management of term infants (≥37weeks) at risk of hypoglycaemia



Identification and Management of Neonatal Hypoglycaemia in the Full Term Infant: A Framework for Practice. British Association of Perinatal Medicine, 2017.

Appendix 3

Flow chart B – Pre-feed BG 1.0-1.9mmol/l and no abnormal signs



Box 1. Signs that may indicate hypoglycaemia

- Lethargy
- Abnormal feeding behaviour especially after a period of feeding well
- High pitched cry
- Altered level of consciousness
- Hypotonia
- Seizures
- Hypothermia (<36.5°C)
- Cyanosis
- Apnoea

Box 2. Supporting breast feeding

- Encourage skin-to-skin contact.
- Offer breast feed and if not feeding effectively teach mother to hand express.
- Give colostrum obtained to baby by the method suitable to parents.
- Continue to encourage hand expression at least 8-10 times in 24 hours and support feeding on the breast until infant is feeding effectively.

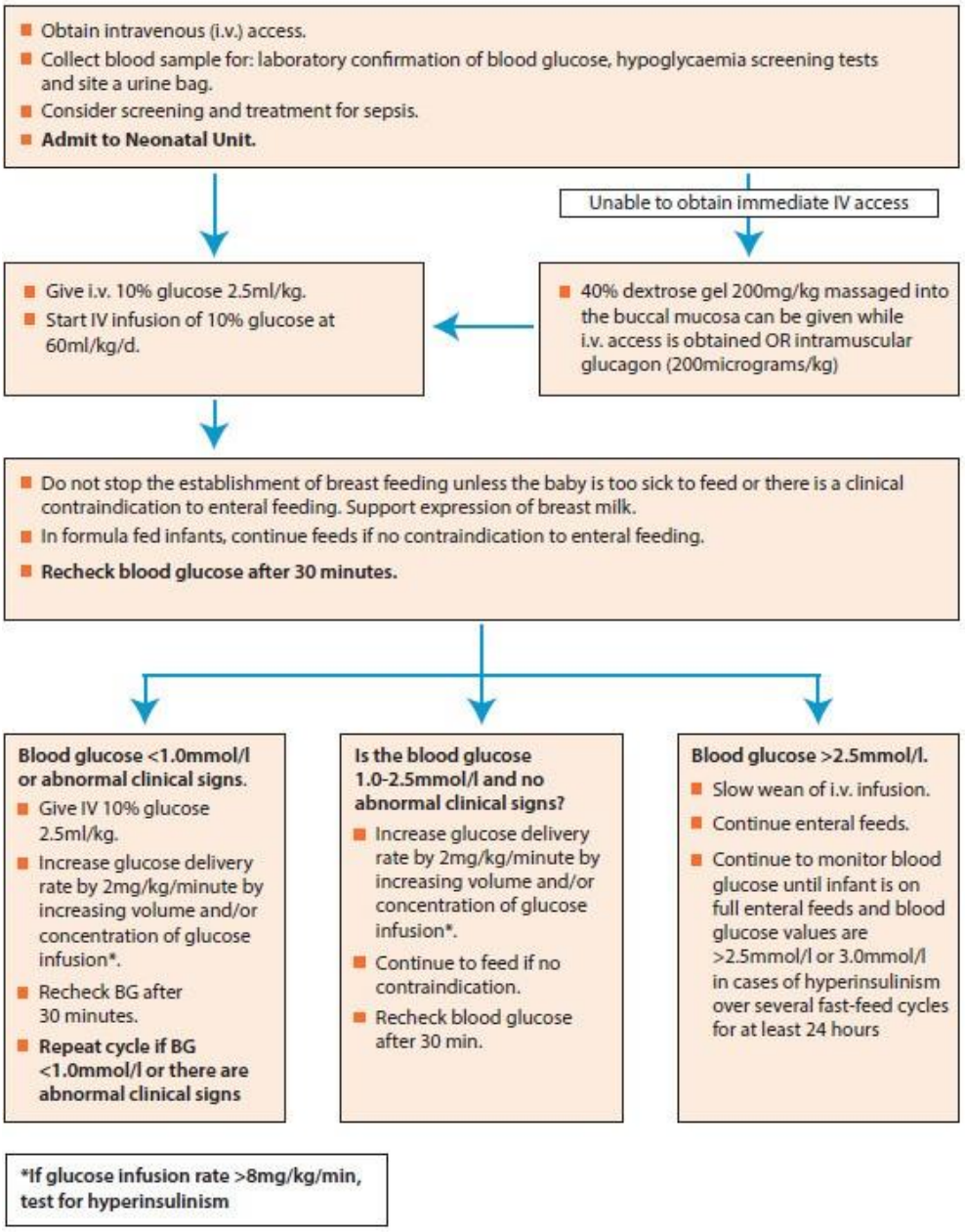
Box 3. If more than 2 measurements 1.0-1.9mmol/l, inform neonatal team.

- Investigate for causes of hyopglycaemia, consider sepsis.
- Consider increased feed frequency, nasogastric tube insertion or IV infusion of 10% glucose.

Identification and Management of Neonatal Hypoglycaemia in the Full Term Infant: A Framework for Practice. British Association of Perinatal Medicine, 2017.

Appendix 4

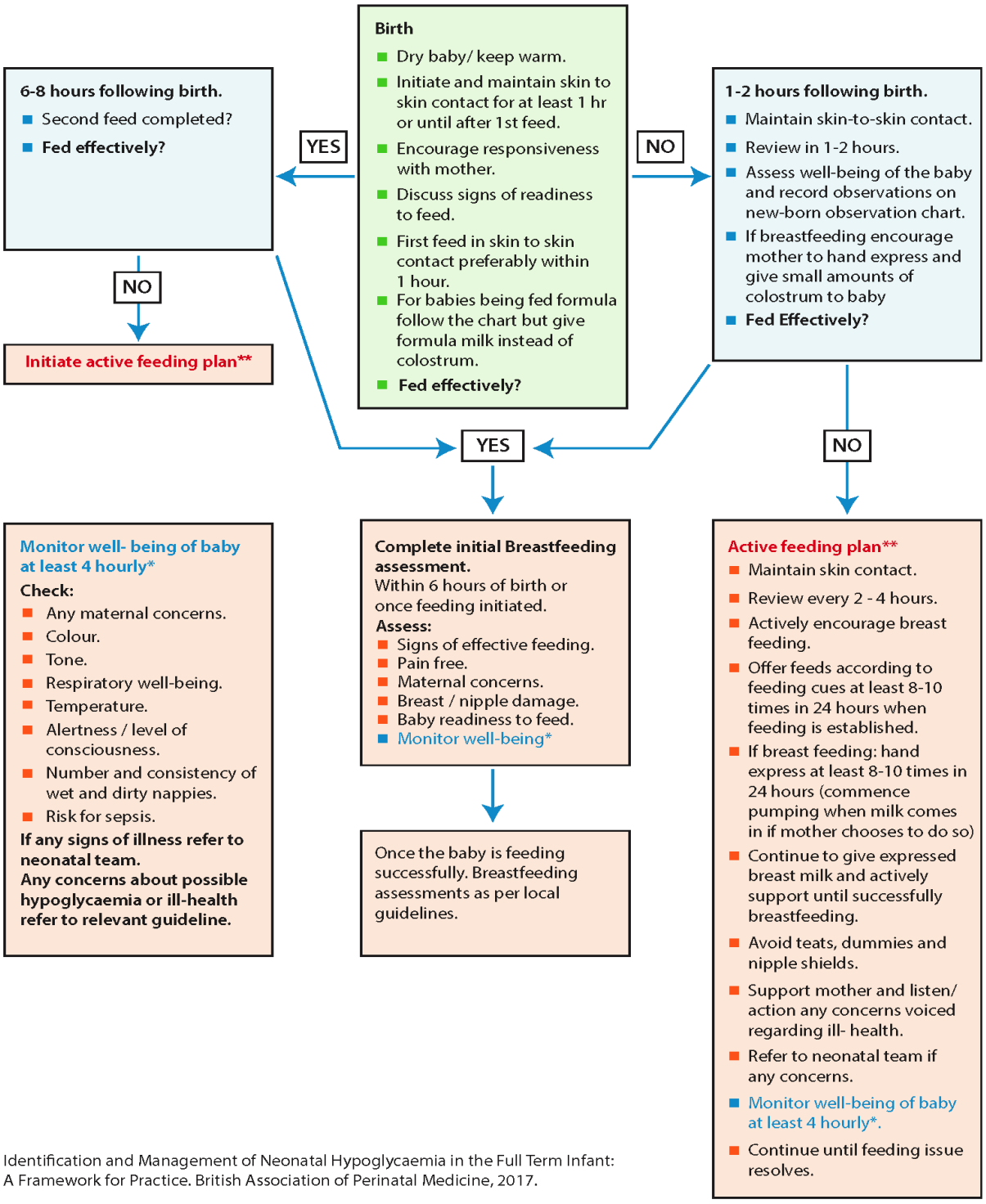
Flow chart C- Blood glucose < 1.0mmol/l and/or clinical signs consistent with hypoglycaemia



Identification and Management of Neonatal Hypoglycaemia in the Full Term Infant: A Framework for Practice. British Association of Perinatal Medicine, 2017.

Appendix 5

Flowchart D. Management of reluctant feeding in healthy term infants ≥ 37 weeks



Identification and Management of Neonatal Hypoglycaemia in the Full Term Infant: A Framework for Practice. British Association of Perinatal Medicine, 2017.

Appendix 6

Patient information Sheet: Protecting your Baby from Low Blood Glucose

What is low blood glucose?

You have been given this leaflet because your baby is at increased risk of having low blood glucose (also called low blood sugar or hypoglycaemia).

Babies who are small, premature, unwell at birth, or whose mothers are diabetic or have taken certain medication (beta-blockers), may have low blood glucose in the first few hours and days after birth, and it is especially important for these babies to keep warm and feed as often as possible in order to maintain normal blood glucose levels.

If your baby is in one of these “at risk” groups, it is recommended that they have some blood tests to check their blood glucose level. Extremely low blood glucose, if not treated, can cause brain injury resulting in developmental problems. If low blood glucose is identified quickly, it can be treated to avoid harm to your baby.

Blood glucose testing

Your baby’s blood glucose is tested by a heel-prick blood test. A very small amount of blood is needed and it can be done while you are holding your baby in skin-to-skin contact. The first blood test should be done before the second feed (2-4 hours after birth), and repeated until the blood glucose levels are stable.

You and your baby will need to stay in hospital for the blood tests.

How to avoid low blood glucose

- **Skin-to-skin contact**

  Skin-to-skin contact with your baby on your chest helps keep your baby calm and warm and helps establish breastfeeding. During skin-to-skin contact your baby should wear a hat and be kept warm with a blanket or towel.

- **Keep your baby warm**

  Put a hat on your baby for the first few days while he/she is in hospital. Keep your baby in skin contact on your chest covered with a blanket and look into you babies eyes to check his / her well-being in this position, or keep warm with blankets if left in a cot.

- **Feed as soon as possible after birth**

  Ask a member of staff to support you with feeding until you are confident, and make sure you know how to tell if breastfeeding is going well, or how much formula to give your baby.

- **Feed as often as possible in the first few days**

  Whenever you notice “feeding cues” which include rapid eye movements under the eyelids, mouth and tongue movements, body movements and sounds, sucking on a fist, offer your baby a feed. Don’t wait for your baby to cry – this can be a late sign of hunger.

- **Feed for as long, or as much, as your baby wants**.

  To ensure your baby gets as much milk as possible.

- **Feed as often as baby wants, but do not leave your baby more than 3 hours between feeds.**

  If your baby is not showing any feeding cues yet, hold him/her skin-to-skin and start to offer a feed about 3 hours after the start of the previous feed.

- **Express your milk (colostrum).**

  If you are breastfeeding and your baby struggles to feed, try to give some expressed breast milk. A member of staff will show you how to hand express your milk, or watch the UNICEF hand expression video (search “UNICEF hand expression”). If possible, it is good to have a small amount of expressed milk saved in case you need it later, so try to express a little extra breast milk in between feeds. Ask your midwife how to store your expressed milk.

Don’t hesitate to tell staff if you are worried about your baby

If your baby appears to be unwell, this could be a sign that they have low blood glucose. As well as doing blood tests, staff will observe your baby to check he / she is well, but your observations are also important, as you are with your baby all the time so know your baby best. **It is important that you tell staff if you are worried** that there is something wrong with your baby, as parents’ instincts are often correct.

The following are Indications that your baby is well:

- **Is your baby feeding well?**

  In the first few days your baby should feed effectively at least every 3

hours, until blood glucose is stable, and then at least 8 times in 24 hours. Ask a member of staff how to tell if your baby is attached and feeding.

effectively at the breast, or how much formula he / she needs. If your baby becomes less interested in feeding than before, this may be a sign they are unwell and you should raise this with a member of staff.

- **Is your baby warm enough?**

  Your baby should feel slightly warm to touch, although hands and feet can sometimes feel a little cooler. If you use a thermometer the temperature should be between 36.5˚C and 37.5˚C inclusive.

- **Is your baby alert and responding to you?**

  When your baby is awake, he/she will look at you and pay attention to your voice and gestures. If you try to wake your baby, they should respond to you in some way.

- **Is your baby's muscle tone normal?**

  A sleeping baby is very relaxed, but should still have some muscle tone in their body, arms and legs and should respond to your touch. If your baby feels completely floppy, with no muscle tone when you lift their arms or legs, or if your baby is making strong repeated jerky movements, this is a sign they may be unwell. It can be normal to make brief, light, jerky movements. Ask a member of the team if you are not sure about your baby's movements.

- **Is your baby's colour normal?**

  Look at the colour of the lips and tongue – they should be pink.

- **Is your baby breathing easily?**

  Babies' breathing can be quite irregular, sometimes pausing for a few seconds and then breathing very fast for a few seconds. If you notice your baby is breathing very fast for a continuous period (more than 60 breaths per minute), or seems to be struggling to breathe with very deep chest movements, nostrils flaring or making noises with each breath out – this is not normal.

Who to call if you are worried

In hospital, inform any member of the clinical staff.

At home, call your community midwife and ask for an urgent visit or

advice. Out of hours, call NHS 111

If you are really worried, take your baby to your nearest A&E department or dial 999.

What happens if your baby's blood glucose is low?

If the blood glucose test result is low, your baby should feed as soon as possible and provide skin-to-skin contact. If the level is very low the neonatal team may advise urgent treatment to raise the blood glucose and this could require immediate transfer to the Neonatal Unit.

Another blood glucose test will be done before the next feed or within 2-4 hours.

If you are breastfeeding and your baby does not breastfeed straight away, a member of staff will review your baby to work out why. If he / she is happy that your baby is well, she/he will support you to hand express your milk and give it by oral syringe / finger / cup / spoon.

If your baby has not breastfed, and you have been unable to express any of your milk, you will be advised to offer infant formula.

In some hospitals the team may prescribe a dose of dextrose (sugar) gel as part of the feeding plan because this can be an effective way to bring your baby's glucose level up.

If you are breastfeeding and advised to give some infant formula, this is most likely to be for one or a few feeds only. You should continue to offer breastfeeds and try to express milk as often as possible to ensure your milk supply is stimulated.

Very occasionally, if babies are too sleepy or unwell to feed, or if the blood glucose is still low after feeding, he / she may need to go to the Neonatal Unit. Staff will explain any treatment that might be needed. In most cases, low blood glucose quickly improves within 24-48 hours and your baby will have no further problems.

Going home with baby

It is recommended that your baby stays in hospital for 24 hours after birth. After that, if your baby's blood glucose is stable and he / she is feeding well, you will be able to go home.

Before you go home, make sure you know how to tell if your baby is

getting enough milk. A member of staff will explain the normal pattern of changes in the colour of dirty nappies and number of wet/dirty nappies. For further information, if you are breastfeeding, see ‘How you and your midwife can recognise that your baby is feeding well’ (Search ‘UNICEF Baby Friendly assessment tool’).

It is important to make sure that your baby feeds well **at least 8 times every 24 hours** and most babies feed more often than this.

There is no need to continue waking your baby to feed every 2–3 hours as long as he/she has had at least 8 feeds over 24 hours, unless this has been recommended for a particular reason. You can now start to feed your baby responsively. Your midwife will explain this.

If you are bottle feeding, make sure you are not overfeeding your baby. Offer the bottle when he/she shows feeding cues and observe for signs that he/she wants a break. Don’t necessarily expect your baby to finish a bottle – let him / her take as much milk as he/she wants.

Once you are home, no special care is needed. As with all newborn babies, you should continue to look for signs that your baby is well, and seek medical advice if you are worried at all about your baby.

Appendix 7

Use of dextrose gel for buccal administration

Indications

- Blood glucose 1.0-1.9mmol/l in infant with no abnormal clinical signs
- Infants ≥ 35 weeks' gestational age and younger than 48 hours after birth

Notes

- Must be used in conjunction with a feeding plan
- For babies with severe hypoglycaemia (BG <1.0mmol/l) use oral dextrose gel only as an interim measure while arranging for urgent medical review and treatment with IV glucose

Dose

- Use 200mg/kg dextrose gel (0.5 ml/kg of 40% dextrose gel), up to two doses given 30 minutes apart per episode of hypoglycaemia and a maximum of six doses of buccal dextrose gel in 48 hours.

Weight of baby (kg)	Volume of gel (ml)
1.5-1.99	1
2.0-2.99	1.5
3.0-3.99	2.0
4.0-4.99	2.5
5.0-5.99	3.0
6.0-6.99	3.5

Method of administration

- Draw up correct volume of 40% dextrose gel (Glucogel®) using a 2.5 or 5ml oral / enteral syringe
- Dry oral mucosa with gauze, gently squirt gel with syringe (no needle) onto the inner cheek and massage gel into the mucosa using latex-free gloves
- Offer a feed preferably breast milk, immediately after administering dextrose gel
- Repeat blood sugar measurement as requested
- Repeat oral dextrose gel if baby remains hypoglycaemic according to flow chart

Up to 6 doses can be given over a 48-hour period but any more than one dose should be discussed with the neonatal team and it is advisable for the baby to be examined before the 3rd dose is administered.

Appendix 8

Review Process Prior to Ratification:

Version	Date	Comments	Author
1	14/08/2017		Maternity guideline group
2			Maternity guideline group
3			Maternity guideline group

Name of Group/Department/Committee	Date
Reviewed by Maternity Guideline Group	11/06/2020
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Approved by CBU 3 overarching Governance	29/07/2020
Reviewed at Paediatric Governance	01/07/2020

Archived	Date