Adopted All Wales Identification and Management of Neonatal Hypoglycaemia

Guideline information

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07/10/2028

Summary of document:
This guideline amalgamates the Adopted All Wales; Identification and Management of infants at Risk of neonatal hypoglycaemia in the first 48 hours of life (an adaption of the BAPM framework in practice); the Management of Hypoglycaemia on the Neonatal Unit; the Term Bundle for babies at risk of hypoglycaemia on the postnatal wars and the Preterm Bundle for babies at risk of hypoglycaemia following birth.

Scope:
This guideline, amalgamating the Adopted All Wales guidance for identifying and managing neonatal hypoglycaemia, is for the use of staff in maternity and Special Care baby Unit when caring for neonates who are at risk of becoming, or identified as, hypoglycaemic in the first 48 hours of birth.

The guidance below uses the term 'woman' (pronouns she or her) to describe individuals whose sex assigned at birth was female, whether they identify as female, male or non-binary. It is important to acknowledge it is not only people who identify as women for whom it is necessary to access women's health and reproductive services. Therefore, this should include people who do not identify themselves as women but who are pregnant or have recently given birth.

Obstetric and Midwifery services and delivery of care must therefore be appropriate, inclusive and sensitive to the needs of those individuals whose gender identity does not align with the sex that they were assigned at birth.

Owning group:
Maternity Guideline, Audit and Research Group
07/10/2025

Executive Director job title:
Andrew Carruthers, Chief Operating Officer.

Reviews and updates:
1.0 – New Guideline – 07.10.2025

Keywords
Hypoglycaemia

Contents

Exception

Please note the following exception to this guideline that will be supported in Hywel Dda Health Board.

The Hywel Dda University Health Board **Adopted All Wales Identification and Management of infants at Risk of neonatal hypoglycaemia in the first 48 hours of life** recommends that all blood glucoses are measured only using blood gas analysers for accuracy.

There has been agreement by the Neonatal team that as research and an internal audit supported the conclusion that the StatStrip glucose meter is suitable for use in place of the blood gas analyser in the neonatal hypoglycaemia pathway, it may be used on the post-natal areas where access to a blood gas analyser is not readily available, with the following caveat.

Neonates who had a blood glucose measured using a glucose meter and have reached "C" criteria on the term or preterm pathways part 2 requiring admission to SCBU, must have their blood glucose reading confirmed on a blood gas analyser and / or a lab blood.

Guideline for the identification and Management of Infants at Risk of Neonatal Hypoglycaemia in the First 48 hours of Life

GIG CYMRU NHS WALES | Rhwydwaith Mamolaeth a Newyddenedigol Cymru Wales Maternity and Neonatal Network

All Wales Maternity & Neonatal Guidelines

Guideline for the Identification and Management of Infants at Risk of Neonatal Hypoglycaemia in the First 48 Hours of Life
An Adaptation of the BAPM Framework for Practice

Documents to read alongside/ support this guideline	Appendix 1 Parent Information Leaflet for babies at risk of hypoglycaemia Appendix 2 Effective Breastfeeding check Preterm bundle for babies at risk of hypoglycaemia on the postnatal ward Term bundle for babies at risk of hypoglycaemia on the postnatal ward Reluctant Feeding BAPM

Version Control					
Version	**Date of Review**	**Reviewer name(s)**	**Ratified on**	**New review date**	**Date of Publication**
V2 Current		Dr Jamie Evans	May 2021	May 2025	
Original Version		**Author/s**	**Ratified on**	**Review date**	**Date of Publication**
V1		Dr Jamie Evans, Dr Elisa Smit, Dr Cora Doherty, Sarah Rowley, Jane Gray, Judy Rogers, Allison Lewis	Dec 2018	Dec 2021	

Disclaimer: These guidelines have been ratified at the Maternity/Neonatal Guideline Meeting; however clinical guidelines are guidelines only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt, contact a senior colleague or expert. Caution is advised when using guidelines after the review date.

Authors: J Evans, E Smit, C Doherty, S Rowley, J Gray, J Rogers & A Lewis Review due: May 2024

IMPORTANT: Neonatal Hypoglycaemia is defined as blood glucose of less than 2.0mmol/L in term infants and 2.6mmol/L in preterm infants when using a blood gas analyser to accurately measure. This guideline is ONLY for use when a blood gas analyser is available for all blood glucose measurements. It is only applicable to babies 1) NOT admitted to the NICU and 2) in the first 48 hours of life

High Risk Infants have an impaired counter-regulatory response for a variety of reasons. Blood glucose should be monitored in infants with diseases associated with: 1) low energy availability; 2) impaired hormone / enzyme; or 3) hyperinsulinism

The guidance focuses on these key areas:

a) Partnership with parents
b) Early identification of infants at risk
c) Early and regular feeding starting within the **first hour** after birth
d) Clinical assessment for symptoms of hypoglycaemia
e) Accurate measurement of blood glucose using a blood gas machine.

At Risk babies who should be placed on the Hypoglycaemia Pathway

The following groups of infants are at risk of neurological sequelae of neonatal hypoglycaemia. Measures should be in place to identify them at birth for early milk/energy provision and monitoring of blood glucose concentration. Commence the following babies on the Hypoglycaemia Pathway Part One

1. Intrauterine growth restriction (birth weight <2nd centile) or clinically wasted appearance

Plot the birth weight on the gestation specific growth chart and assess the centile. (See table).
Midwives are at liberty to identify babies from the customized gap grow charts if the baby's birth weight is less than 2nd percentile predicted for that baby.

Birth weight(kg) < 2nd centile by gestation		
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

2. Infants of diabetic mothers

Place all infants of diabetic mothers on the pathway. Please note infants weight and if >98th centile (see table) document this as an additional risk factor in the Hypoglycaemia Care Plan. This does not apply to babies of non-diabetic mums above the 98th centile.

Birth weight (kg) > 98% centile AND infant of diabetic mother		
Gestational age/weeks	Boys	Girls
37	3.8	3.7
38	4.1	3.9
39	4.3	4.1
40	4.5	4.3
41	4.6	4.4
42	4.7	4.5

3. Babies born less than 37 weeks gestation
4. Temperature < 36 degrees C at any time
5. Infants of mothers taking beta-blockers in the third trimester and/or at time of delivery
6. Suspected/ known sepsis
7. Perinatal acidosis (cord arterial or infant pH <7.1 AND base deficit > -12mmol/L)
8. Rare conditions/Family History where the baby is at risk of hypoglycaemia flagged up antenatally or by Neonatologist/Paediatrician

Clinical assessments including the absence or presence of signs of symptomatic hypoglycaemia, must be regularly documented.

IMPORTANT - Signs which can be indicative of Symptomatic Hypoglycaemia

- **Cyanosis**
- **Apnoea**

- **Altered level of consciousness**
- **Seizures**
- **Hypotonia**
- **Lethargy**
- **High pitched cry**

Measurement of blood glucose should be performed for any infant who has one or more of the above signs. Symptomatic hypoglycaemia (BG<2.6mmol/L with clinical signs as above) is an emergency and requires admission immediately to the NICU. Please note that babies displaying the above symptoms should be reviewed by the neonatal team even in the event of a normal blood glucose.

Abnormal feeding behaviour in babies on the pathway especially after a period of feeding well, may be indicative of hypoglycaemia (see signs below)

- Not waking for feeds
- Not sucking effectively
- Drowsiness or lethargy
- Constantly unsettled at the breast eg pulling off and getting distressed when offered the breast

It should prompt a full clinical assessment and blood glucose measurement.
Refer also to the generic reluctant feeder guideline.

Jitteriness - defined as excessive repetitive movements of one or more limbs, which are unprovoked and not in response to a stimulus is common and is not by itself an indication to measure blood glucose. In an at risk baby it may be a sign of hypoglycaemia.

Measurement of Blood Glucose

Samples should be taken from a warm well- perfused heel by heel prick, or from a free flowing sample, using skin asepsis and patient comfort. Air bubbles in capillary tubes should be avoided. Analyse the sample using blood gas analyser on the postnatal ward. Record the result clearly on the chart. Use the result to manage the next stage.

In all of the above situations ensure that 40% dextrose gel is written up prophylactically on the 'as required medicines' part of the prescription record. The dose is 0.5mls/kg. In the event it has not been written up and a dose is required use the SOP Dextrose Gel Administration Guidance found in the Care Bundles to give the required dose so that treatment is not delayed and inform neonatal team.

Start all 'at risk' babies on the Hypoglycaemia Pathway Part One for immediate management at birth (Page 3) with written explanatory notes on Page 4.

I**MPORTANT**: There are separate pathways for term and preterm infants with **different intervention thresholds**. Depending on whether the baby is preterm or term print off and refer to the appropriate hypoglycaemia care bundle following the first blood test.

Each care bundle consists of :

- Hypoglycaemia Pathway Flow Charts (Preterm or Term)
- Hypoglycaemia Care Plan (document feeding, blood glucose and risk score)
- NEWTT Chart (including responsiveness, tone, HR, RR, Temp, colour)
- Dextrose Gel Administration and SOP

Hypoglycaemia Pathway Part one

Dry baby, put on hat, place skin to skin and initiate feeding, keep warm (>36.5)

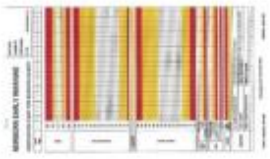
Identify at risk infants (see Box A)
Give and explain Parent information leaflet

Start NEWTTS chart and Hypoglycaemia Care plan and record symptoms/ lack of symptoms at every feed. Get Dextrose gel written up as PRN

First feed, **MUST** be given as early as possible within the first hour.
A breastfeeding baby may feed multiple times before first BG measurement taken
Record first temperature at 1 hour and instigate warming measures as required

Box A – Infants at risk

- IUGR (<2nd centile) or clinically wasted
- Infants of diabetic mothers
- Maternal beta blocker use
- <37 weeks gestation
- Temp <36 C at any time
- Perinatal Asphyxia cord pH <7.1 AND BE > -12
- Rare Conditions/FH as directed
- Sepsis suspected/known



NOTE:
If a blood gas is being done before the first glucose level for anything other than hypoglycaemia then disable the glucose from the analysis to avoid capturing the normal physiological drop following birth.

Bottle feeding
Offer 10mls/kg, via bottle, syringe/cup

Breast feeding
Put to breast but if ineffective feeding hand express and give colostrum

If NO EBM
Give dextrose gel and consider supplement of 5ml/kg formula if mother consents

Is baby <37/40 weeks gestation at birth?

YES

Promote ongoing skin contact and give second feed **2 hours** after 1st feed
First glucose level should be checked pre **third** feed which should be **2 hours** after 2nd feed at 4-5 hours of age and follow
Preterm Infant Hypoglycaemia Pathway and Care Bundle

NO

Promote ongoing skin contact and check glucose level pre second feed which should be within **3 hours** of 1st feed and follow
Term Infant Hypoglycaemia Pathway and Care Bundle

ALL Babies 'At Risk' of Hypoglycaemia - Hypoglycaemia Pathway Part One

Prior to/at delivery
At risk babies should be identified and parent information leaflet given and explained as early as possible. This should include why their baby is receiving extra support and blood glucose monitoring, how the likelihood of hypoglycaemia can be minimised and the signs that could indicate that baby is becoming unwell. Focus on signs indicative of hypoglycaemia and measures to minimise occurrence.

Management immediately after birth

- Baby should be dried, covered and a hat put on.
- He/she should be placed skin to skin with the mother to provide warmth and facilitate the initiation of feeding.
- Feeding should commence as soon as skin to skin is achieved and must be **within the first hour**
- Ensure the ambient temperature is warm, the room is free from draughts, show safe positioning of the baby and commence observations.
- Regular observations include colour, tone, respiratory rate, heart rate, temperature, level of consciousness and signs associated with hypoglycaemia, recorded using the NEWTTS chart.
- Feeds including, type, volume and duration should be documented on the Hypoglycaemia Care Plan. Blood glucose results should also be recorded here with the time of the sample and the signature of the person testing. In addition the risk factors for hypoglycaemia for each baby should be recorded here on the Hypoglycaemia Care Plan along with date and time of birth.

Breastfeeding
Ensure that baby is offered the breast as soon as possible **within the first hour** and offer:

a) Breastfeeding support
b) Advice on recognition of early feeding cues (rapid eye movements under the eye lids, mouth and tongue movements, body movements and sounds, sucking on a fist)
c) Advice on signs of effective attachment.

Document feeding cues and feeding effectiveness at each feed. If feeding is ineffective, encourage continuous skin to skin and teach hand expression. Any colostrum expressed should be fed immediately to the baby. Continue to offer the breast in response to feeding cues as often as possible

Continue to express at least 8 – 10 times per 24 hour period until baby is feeding effectively and provide active feeding support until breastfeeding is established**. If no colostrum is available and after discussion with the mother, try expressing hourly, aiming for 5 mls colostrum in 3 hours. Consider use of dextrose gel or consider supplementing with term formula milk 10mls/kg per feed) until colostrum is available.** Support to resume breast milk feeds as soon as possible.

Formula feeding
For women who choose to formula feed, offer 10mls/kg as soon as possible **within the first hour**. Aim to give at least 80 - 100mls/kg/day in this group because formula milk has lower availability of cerebral alternative fuels.

IMPORTANT
From this stage forward, the management of term and preterm infants is NOT the same and a different care pathway will be used for each group from now on.
The following explanatory notes are separated into term and preterm sections accordingly and should be used with the appropriate term/preterm care bundle which should be printed and placed in baby's notes.

Management of TERM Infants following first blood glucose measurement

1. Following the first feed which should be offered within the first hour, the first blood glucose measurement should be just before the second feed. In practice for the term infant who is well this should be no more than 3 hours from the first feed. An infant who does not show any feeding cues within four hours of birth, should prompt BG measurement by 4 hours and administration of a feed by tube, cup or syringe.

2. Measure blood glucose immediately if there are signs in keeping with **symptomatic hypoglycaemia** (see Page 2) at any time on this pathway. Symptomatic hypoglycaemia is a medical emergency and should be followed immediately by measures to correct it (Buccal dextrose gel or IM glucagon 200 micrograms / kg up to a maximum of 1 mg as a single dose) along with the siting of an IV line and consideration of a full hypoglycaemia work up.

Following First Blood Glucose Measurement – Term Hypoglycaemia Pathway Part 2

3. Based on the result of the first blood glucose (BG) measurement, place the baby on one of the following sections of the Term Hypoglycaemia Care Pathway Part 2 and follow guidance:

   A) **Blood glucose ≥ 2.0mmol/L and no abnormal signs.** Start green section (left hand side of chart). Support ongoing breastfeeding and feed 3 hourly (breastfed babies may feed more frequently). If baby not breast feeding effectively try expressing aiming for at adequate amounts of colostrum/3 hours. Once baby has achieved 3 BG ≥ 2mmol/L monitoring may be stopped unless any abnormal signs. Babies should be observed in hospital for 24 hours from the first 3 hourly BG ≥ 2mmol/L to ensure full establishment of feeding.

   B) **Blood Glucose 1.0 to 1.9mmol/L, and no abnormal signs**.
   Start amber section (middle section of chart) Support ongoing breast feeding and feed 2 hourly (breastfed babies may feed more frequently). If baby not breast feeding try expressing and ensure there are adequate amounts of colostrum/3 hours, give dextrose gel and consider supplement with formula milk 7.5mls/kg per feed if insufficient colostrum/feeding. Please note in the amber section, babies with multiple risk factors and a BG <2.0mmol/L should be highlighted to the Neonatal team at the first low result for review. Once babies have achieved 3 consecutive BG>2.0mmol/L on 2 hourly feeds, if feeding well and asymptomatic, can move to the green pathway for BG monitoring on 3 hourly feeds

   C) **Blood Glucose <1.0mmol/L, OR clinical signs consistent with hypoglycaemia with Blood Glucose <2.6mmol/L OR 3 values <2.0mmol/L in the first 48 hours.**
   Admit to neonatal unit promptly for consideration of hypoglycaemia workup and urgent IV dextrose as per red section of pathway part two (right hand side). Give dextrose gel.

If there are still concerns following neonatal team review, the midwife must escalate appropriately first to the registrar and then to the responsible consultant and document this in the medical records.

Further care before discharge

Do not discharge babies with risk factors for impaired metabolic adaptation and hypoglycaemia to community care until you are satisfied that the baby is maintaining blood glucose levels ≥ 2.0 mmol/L on at least three consecutive occasions on 3 hourly feeds and is feeding well.

All Infants at risk of hypoglycaemia should not be transferred to the community until they are at least 24 hours old from completion of their first of three blood glucose levels above 2.0mmol/L on 3 hourly feeds and where mother and midwife are satisfied that effective feeding is established.

In addition, in babies where there has been requirement for 2 hourly feeds due to blood glucose levels being below 2.0mmol/L you should ensure the baby has been reviewed by the neonatal 'baby check' doctor on day of discharge in addition to the usual reviews during their stay.

Management of PRETERM Infants (<37 weeks) following first blood glucose measurement

Preterm infants are at risk of hypoglycaemia and generally may have lower reserves than term infants. In addition they are at risk of difficulties in establishing feeds and maintaining good thermoregulation. These babies often need longer stays in hospital to ensure establishment of feeding, show ability to gain weight and therefore require closer monitoring.

We should ensure these babies are able to maintain blood glucose levels on 2 hourly feeds before progressing to 3 hourly amounts.

In addition, the intervention threshold will not be changed to 2.0mmol/L from 2.6mmol/L until further evidence is available of its' safety in this group of babies.

1. Following the first feed which should be offered within the first hour, a second feed should be given 2 hours from the first feed. A blood glucose measurement should NOT be taken at this time. The first blood glucose measurement should be just before the third feed. In practice for the preterm infant who is well this should be around 4-5 hours of age. **The reason for not taking a blood glucose before the second feed is that babies naturally experience a blood sugar drop following birth which should return to normal by 4hours of age. By taking the sample at 2-3 hours of age the baby is still within the period for the natural low levels which may falsely be interpreted as hypoglycaemia requiring intervention**. An infant who does not show any feeding cues within the first 3 hours following birth, should prompt BG measurement by 3 hours and administration of a feed by tube, cup or syringe.

2. Measure blood glucose immediately if there are signs in keeping with **symptomatic hypoglycaemia** (see Page 2) at any time on this pathway. Symptomatic hypoglycaemia is a medical emergency and should be followed immediately by measures to correct it (Buccal dextrose gel or IM glucagon 200 micrograms / kg up to a maximum of 1 mg as a single dose) along with the siting of an IV line and consideration of a full hypoglycaemia work up.

Following First Blood Glucose Measurement – Preterm Hypoglycaemia Pathway Part 2

3. Based on the result of the first blood glucose (BG) measurement, place the baby on one of the following sections of the Preterm Hypoglycaemia Care Pathway Part 2 and follow guidance:

   A) Blood glucose ≥ 2.6mmol/L and no abnormal signs. Start green section (left hand side of chart). Support ongoing breast feeding and feed 2 hourly (breastfed babies may feed more frequently). If baby not breast feeding effectively try expressing ensuring adequate colostrum/3 hours. Consider supplementing with formula milk 7.5mls/kg per feed if insufficient colostrum obtained. Once baby has achieved 3 BG>2.6mmol/L on 2 hourly feeds they should be maintained on 2 hourly feeds for a further 12 hours with no further BG monitoring if feeding well and asymptomatic. Babies should then move to 3 hourly feeds until a further 3 consecutive BG levels are above 2.6mmol/L

   B) Blood Glucose 1.4 to 2.5mmol/L, and no abnormal signs.
   Start amber section (middle section of chart) Give buccal dextrose gel. Support ongoing breast feeding and feed 2 hourly (breastfed babies may feed more frequently). If baby not breast feeding try expressing ensuring adequate colostrum/3 hours, and consider a) supplement with formula 7.5mls/kg per feed milk if inadequate colostrum available and b) placement of NGT. Babies should be highlighted to the Neonatal team at the first low result for review. If a repeat BG level is 2.6mmol/L or above babies can move to the top of the green pathway (left side of chart)
   If a second BG <2.6mmol/L and >1.4mmol/L and asymptomatic, insert an NGT if not already done so, continue to support breastfeeding and inform the neonatal team for review. Following a review by the neonatal team the baby may be:
   a) Started on an individualised plan which may include placement of NGT if not already done, increasing feed volume if tolerated by baby and ensuring all other parameters are normal by careful

examination of the baby and review of the observation chart

b) Admitted to NICU

If a baby is started on an individualised plan and not admitted a further blood glucose level should be taken prior to the next feed. If this BG level is 2.6mmol/L or above, the baby can continue on the individualised plan that achieved the normal BG level as long as the next 3 BG levels are normal. The baby should then have a further review by the neonatal team with a plan to move to the green pathway. A 3rd BG<2.6mmol/L at any time means the baby should be urgently reviewed and admitted to NICU as per the red pathway on the right side of the chart.

C) **Blood Glucose <1.4mmol/L, OR clinical signs consistent with hypoglycaemia with Blood Glucose <2.6mmol/L OR 3 values <2.6mmol/L in the first 48 hours.**
Treat as a medical emergency
Give buccal dextrose 200mg/kg
Inform neonatal team immediately and admit to neonatal unit promptly for consideration of hypoglycaemia workup and urgent IV dextrose as per red section of pathway part two (right hand side)

If at any time a midwife is not happy with the actions from the neonatal team, she must escalate appropriately first to the registrar and then to the responsible consultant and document this in the medical records.

Further care before discharge

All Infants at risk of hypoglycaemia should not be transferred to the community until they are at least 24 hours old from completion of their first of three blood glucose levels above 2.6mmol/L on 3 hourly feeds and where mother and midwife are satisfied that effective feeding is established.

Importantly, preterm babies often require longer to fully establish feeding, maintain their temperature and are at higher risk of significant weight loss. We must ensure these babies are able to consistently maintain their blood glucose levels prior to discharge.

All preterm babies should be monitored on the postnatal ward/transitional care routinely by the neonatal team but in addition you should ensure the baby has been reviewed by the neonatal team on the day of discharge so that all aspects of their care can be reviewed before discharge.

All babies born in MLU or Community

All babies born in MLU or in the community

Screen all babies at birth as described previously (p1-2). Take measures to keep baby warm in particular by promoting continuous skin to skin and initiate an early feed. Babies identified as requiring initiation on the pathway must be transferred out promptly to a hospital postnatal ward where regular blood glucose measurements can be undertaken. Use a transwarmer if available. If unavailable ensure sufficient warming measures to maintain temperature. Low temperature will increase chance of hypoglycaemia. Ensure a feed and a single bolus of 40 % buccal dextrose (0.5mls/kg) is given prior to transfer.

All babies regardless of risk factors should be monitored for:

1. Signs of symptomatic hypoglycaemia (see above)
2. Abnormal feeding behaviour
3. Hypothermia (see below)
   One temperature of 36-36.5ºC can be treated by warming measures and a feed. A repeat temperature must be checked in 1 hour. A second temperature <36.5ºC warrants admission. Any babies falling into this category above should be given a bolus of dextrose gel and a feed prior to prompt transfer.

Management of Hypoglycaemia on the Neonatal Unit

The definition of hypoglycaemia remains controversial.
For all babies admitted to the neonatal unit <2.6mmol/l is generally accepted as hypoglycaemia in a term or preterm infant.

NOTE: The definition for hypoglycaemia for TERM babies on the postnatal ward in the first 48 hours of life is <2.0mmol/L. This is the ONLY instance where this is acceptable, and the threshold increases to 2.6mmol/L for those who fail management on the postnatal ward/have other medical conditions that require admission.

Symptomatic hypoglycaemia may cause long term neurological injury in up to 50% of cases, but the duration of hypoglycaemia required for this to occur is unclear. Occipital brain injury associated with hypoglycaemia can result in long term disability, epilepsy and visual impairment.

Causes of hypoglycaemia	
Endocrine	
Hyperinsulinism	Maternal Diabetes, IUGR, Congenital, Beckwith-Wiedemann, HIE, IUGR
Adrenal insufficiency	
Hypopituitarism	Partial or Panhypopituitarism
Metabolic	
Disorders of fatty acid metabolism	LCFA/MCFA oxidation deficiency
Disorders of carbohydrate metabolism	Glucose -6-phosphatase deficiency Glycogen synthase deficiency Galactosaemia
Disorders of Organic Acid Metabolism	Maple syrup urine disease
Disorders of gluconeogenesis	Fructose-1,6- biphosphatase deficiency
Other causes	
'At risk' infants - see across	

At Risk Infants	
Maternal conditions	Diabetes - Gestational, Type 1 and Type 2
	Medications - beta-blockers/ oral hypoglycaemics (any in last trimester)
	Intrapartum IV glucose administration
Neonatal problems	Preterm
	IUGR
	Macrosomic baby of IDDM
	Perinatal hypoxia-ischaemia
	Hypothermia
	Infection
	Polycythaemia
	Infants on parenteral nutrition
	Obvious syndromes eg. midline defects

- Obtain a full history and examine carefully.
- Any at-risk infants and/or unwell infants should be monitored for hypoglycaemia.
- Symptoms of hypoglycaemia include jitteriness, irritability, poor feeding, hypothermia, lethargy, hypotonia, apnoea and seizures.
- Most babies have transient hypoglycaemia either due to substrate deficiency (IUGR, Prematurity and stress) or transient hyperinsulinism.
- Occasionally, some babies will require further investigations due to persistent hypoglycaemia in order to exclude rare metabolic/endocrine disorders.
- Have a low threshold to consider infection and perform a septic screen in all babies with persistent hypoglycaemia.

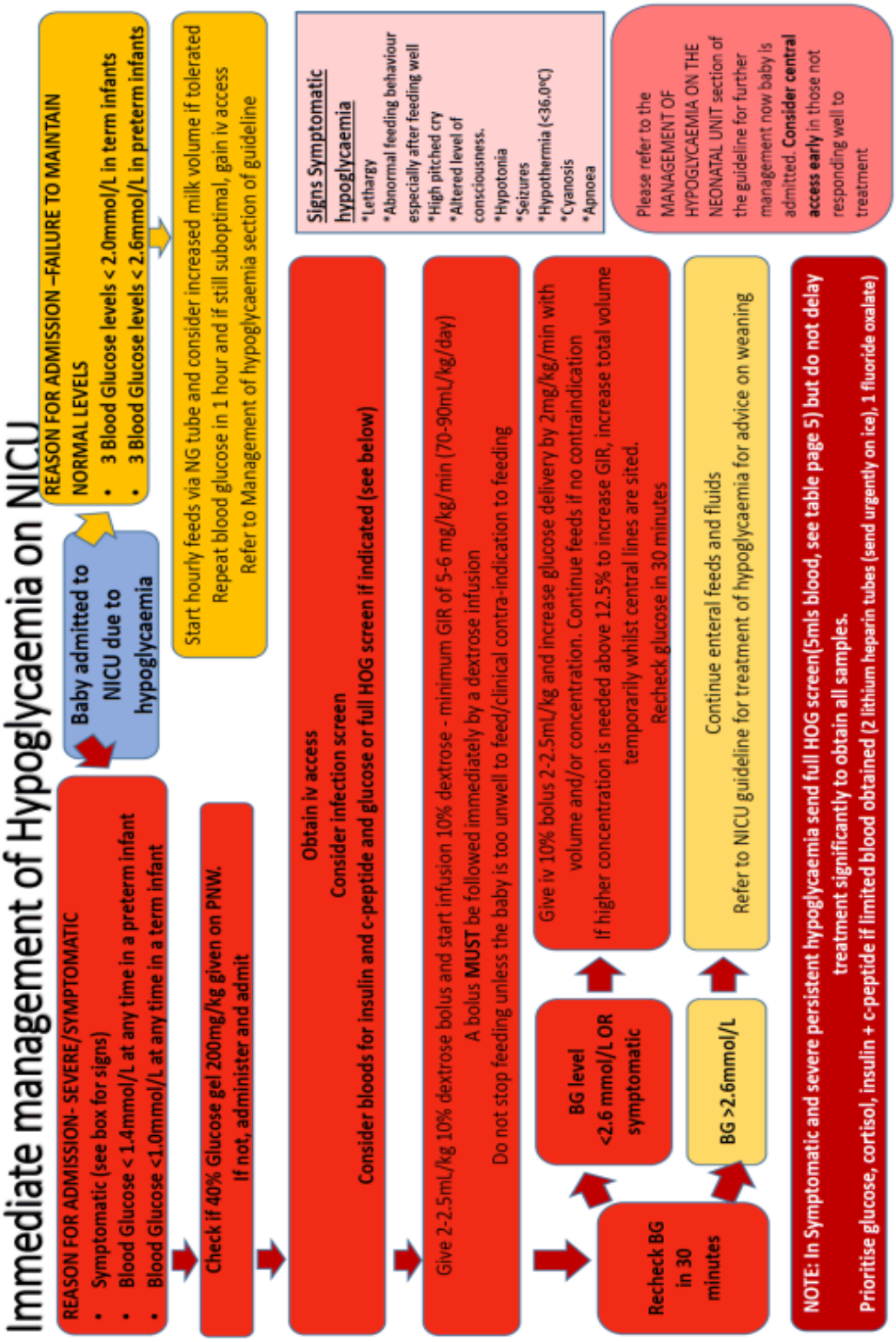
Consider Metabolic/ endocrine disorders in the following situations:

- Hypoglycaemia requiring a glucose infusion rate >8mg/kg/minute
- Family history of sudden infant death, Reye's syndrome or developmental delay
- Hypoglycaemia in an otherwise healthy, well-grown infant with no obvious risk factors
- Persistent or recurrent hypoglycaemia despite adequate treatment
- Hypoglycaemia with seizures or abnormalities of consciousness
- Hypoglycaemia in association with other abnormalities eg. midline defects, micropenis, undescended testis, poor scrotal development, exomphalos, erratic temperature control

Most patients with hypoglycemia improve quickly with appropriate management (optimum feeding and IV fluids). However, occasionally such as in the above situations a hypoglycemia screen (HOG screen) may be indicated. Please discuss with the Tier 2 doctor before doing a hypoglycaemia (HOG) screen. (see section on persistent hypoglycaemia for HOG screen bloods and endocrine involvement)

For babies admitted to the NICU due to hypoglycaemia please see the flowchart for immediate management of hypoglycaemia on the NICU (next page)

Immediate management of Hypoglycaemia in SCBU



Management of Hypoglycaemia on the Neonatal/ Special Care Baby Unit.

Management of Hypoglycaemia on the Neonatal Unit

Intervention Thresholds for hypoglycaemia:

- ALL babies on the neonatal unit – maintain at a minimum of 2.6mmol/L unless they fall into categorie below where intervention threshold is higher
- Persistent hypoglycaemia/Suspected hyperinsulinism >3.5mmol/L
- Hypoxic Ischaemia Encephalopathy - >2.6mmol/L BUT * Keep GIR above 3.5mg/kg/min

Ie. All levels below 2.6mmol/L should be flagged up to the medical team.

Occasionally, when levels are between **2.0 and 2.5mmol/L** in a **term** infant **< 48 hours of age** the clinician may decide that this level is acceptable. This is dependent on the clinical situation and decision should be made by ar experienced clinician with further monitoring of the blood glucose thereafter.

Blood glucose levels should always be taken from a warm foot by heel prick sample or alternatively by venous sample if appropriate and analysed using a blood gas analyser

Glucose Infusion Rate Calculation

$$\text{GIR} = \frac{0.167 \times \text{Infusion rate of fluid(mL/hr)} \times \text{concentration of Glucose administered (\%)}}{\text{weight (kg)}}$$

Example:
2kg baby on 12.5% dextrose at 120mls/kg/day

$$\text{GIR} = \frac{0.167 \times 10(\text{mL/hr}) \times 12.5(\%)}{2(\text{kg})} = 10.4\text{mg/kg/min}$$

Reference table for GIR provided at varying infusion rates and concentration of glucose

Infusion volume	10% Glucose	12.5% Glucose	15% Glucose	20% Glucose
(mL/kg/day)	(Glucose mg/kg/min)			
30	2.1	2.6	3.1	4.2
40	2.8	3.5	4.2	5.6
50	3.5	4.4	5.2	6.9
60	4.2	5.2	6.2	8.3
70	4.9	6.1	7.3	9.7
80	5.6	7.0	8.3	11.1
90	6.3	7.8	9.4	12.5
100	7.0	8.7	10.4	13.9
110	7.7	9.6	11.5	15.3
120	8.4	10.4	12.5	16.7
130	9.1	11.3	13.5	18.0
140	9.8	12.2	14.6	19.4
150	10.5	13.0	15.6	20.8

Management of Hypoglycaemia when blood glucose <intervention threshold and infant is asymptomatic.

Management of Hypoglycaemia when blood glucose < intervention threshold and infant is asymptomatic:

NOTE: Please move to section below for Management of Symptomatic/Persistent Hypoglycaemia if:

- **Infant is symptomatic**
- **Blood glucose is <1.4mmol/L and infant is preterm**
- **Blood glucose <1.0mmol/L in term infants**
- **Concerns regarding recurrent episodes of hypoglycaemia**

OTHERWISE:

- Increase feed volumes to one day ahead and consider decreasing feed intervals from three hourly to two, or one hourly if necessary. Repeat blood glucose in 1 hour.

-If repeat blood glucose is 2.0 - 2.5mmol/L, further intervention is needed, and IV glucose should be considered. Start IV dextrose 10% at 50% of total daily fluid volume and give 50% feeds and recheck blood glucose in 1 hour.

-If the blood glucose is <2.0mmol/L, start IV dextrose at 100% of daily total fluid volume until a glucose above 2.6mmol/L is achieved.

- Reintroduce milk feeds as soon as blood sugars allow. Initially, with hourly or two hourly feeds. Breast milk is preferable as it is more ketogenic. As milk intake increases decrease IV fluids accordingly.
- If having difficulty titrating feeds up quickly due to persistent hypoglycaemia, see regime below and consider causes.

Management of Symptomatic/Persistent Hypoglycaemia

Primary aim: Obtain a Blood Glucose above 2.6mmol/L as swiftly as possible

- If neurological signs are present or BG is <2.6mmol/L give a minibolus of Dextrose 200mg/kg **(2ml/kg 10% dextrose) followed immediately** with a glucose infusion
- Start Dextrose with a glucose infusion rate (GIR) of at least 5-6 mg/kg/min (70-90mls/kg/day) and check blood sugar 20-30 minutes later
- If blood glucose <2.6mmol/L, consider a further bolus and increase the GIR by 1-2mg/kg/min by increasing the total fluids (increase up to one day ahead). Recheck blood sugar after a further 20-30 minutes.
- If blood glucose remains <2.6mmol/L increase the concentration of Dextrose in 2.5% intervals (ie up to 12.5% and then 15% and further if necessary). After each change check blood sugar after 20-30 minutes. Continue until the blood sugar is maintained >2.6mmol/l.

Secondary aim: Maintain Blood Glucose above 2.6mmol/L until stable

- Have a low threshold for inserting central access (Umbilical Venous Catheter, Long line) especially in cases where fluid restriction is needed. A central line is needed once the concentration of glucose is greater than 12.5% therefore, if you are starting 12.5% you should insert a central line immediately.
- **NOTE: If requiring glucose infusion rate rises above 8mg/kg/min, then hyperinsulinism should be suspected and treated according to that guideline with an intervention threshold of 3.5mmol/L**

If GIR remains below 8mg/kg/min and blood glucose levels stabilize with measures above:

- Reintroduce feeds as soon as tolerated. Remember that breast milk is preferable as it is more ketogenic. Monitor blood glucose at least 4 hourly once stable.
- After 2 consecutive blood glucose levels >2.6mmol/l are achieved, consider reducing the IV Dextrose whilst increasing feed by decreasing the GIR by no more than 1mg/kg/min. Repeat this process of decreasing the IV intake and increasing the feeds until the patient is on full feeds and IV fluids have discontinued.
- Remember that decreasing the fluid rate will lead to variable GIR changes; for the same volume change the GIR will drop more in a smaller baby. Please look at GIR calculation above.
- If whilst weaning the blood glucose drops to <2.6mmol/L, increase the GIR by 1mg/kg/min and recheck in 1 hour.
- If you are struggling to wean on repeated occasions, consider increasing threshold for weaning to 3.5mmol/L to maintain stability and consider other causes such as hyperinsulinism.

- Whilst weaning IV Glucose remember to decrease concentration back to 10% glucose prior to final discontinuation.

Babies with Hypoxic Ischaemic Encephalopathy

- The intervention threshold for babies being treated with HIE is still 2.6mmol/L BUT GIR should be >3.5mg/kg/min
- These babies are at higher risk of injury through hypoglycaemia as they have already had a cerebral insult and will be likely to have used up their reserve energy supplies
- These babies are also managed with restricted fluids of 40mls/kg/day and will be receiving no enteral feeds
- ALWAYS work out the GIR and give >3.5mg/kg/min (Basic metabolic requirements of the brain)

Routine monitoring when on intravenous fluids for hypoglycaemia

- Infants **who have experienced hypoglycaemia** and are on intravenous fluids with a stable blood glucose should continue to have blood glucose levels monitored even when there has been no change in management 8-12 hourly.
- Infants who have shown **sensitivity to small changes in GIR/multiple episodes of hypoglycaemia** should have blood glucose levels monitored even when there is no change every 4-6 hours.

SOME IMPORTANT LEARNING POINTS TO REMEMBER

- Term infants can utilize ketone bodies as an addition source of fuel for the brain and this may offer some protection in term infants when hypoglycaemic – Preterm infants are not thought to be able to utilize ketone bodies in this way so are potentially more susceptible to hypoglycaemia causing injury
- Basic metabolic needs for the brain are supplied with a GIR of around 3.5mg/kg/min – ALWAYS work out the Glucose Infusion Rate, in particular in fluid restricted babies to ensure they are receiving this

Persistent Hypoglycaemia (despite above measures)

When hypoglycaemia is persistent, we need to consider causes other than transient hyperinsulinism or substrate deficiency.
In these cases, the most common cause is hyperinsulinism (see separate document on management of hyperinsulinism) but further investigations for rarer causes must be completed.
If a full HOG screen has not already been sent, it should be sent when the baby is hypoglycaemic. (see below)

Investigations for HOG screen if required:

Blood tests to be taken at time of persistent hypoglycaemia			
Test	**Bottle**	**Test**	**Bottle**
Glucose and Lactate		Ammonia (on ice)	
Cortisol		Non esterified fatty acids	
Insulin + C-Peptide		Plasma Amino acids	
Acylcarnitine	Blood spot screening card	3-OH butyrate (ketone body)	
Urine tests (first urine void after hypoglycaemic episode)			
Organic acids			

5mls of blood and 3mls of urine total - Please insert bottle colours for each blood test above in the table following discussion with the local laboratory as these may differ between units
Universal are 1x Guthrie card for Acylcarnitines, 1x white top urine bottle for organic acids, 1x capillary gas tube

The investigations below are also required; however, they can be done once glucose has been administered.

U&E	LFT	Blood Culture	CRP
TFT	17-OHP	Galactosaemia Screen	
1 x culture bottle, 1x white top bottle for TFT, 4x lithium heparin			

Other investigations to consider depending on the clinical picture include: Cranial Ultrasound scan, ophthalmology examination and MRI of the head.

References:
1) Deshpande S, Ward Platt MP. The investigation and management of neonatal hypoglycaemia. Seminars in Fetal and Neonatal Medicine (2005)10, 351-361.
2) Cornblath M, Hawdon JM, Williams AF, Aynsley-Green A, Ward-Platt MP, Schwartz R et al. Controversies regarding definition of neonatal hypoglycaemia: suggested operational thresholds. Pediatrics 2000:105:1141-5.
3) Aynsley- Green A, Hussain K, Hall J, Saudubray JM, Nihoul Fekete C, De Lonlay- Debeney P etal. Practical management of hyperinsulinism in infancy. Arch Dis Child Fetal and Neonatal Ed 2000;82: F98-F107.
4) National Metabolic Biochemistry Network 'Guidelines for investigations of hypoglycaemia in infants and children' Feb 2011
5) Management Strategies for Neonatal Hypoglycaemia: J Pediato Pharmocol 2013 Jul-Sep; 18(3):199-208 C B Sweet, S Grayson, M Polak

Hypoglycaemic Bundles

Please ensure that the following paperwork bundles are used when caring for babies at risk of hypoglycaemia following birth.

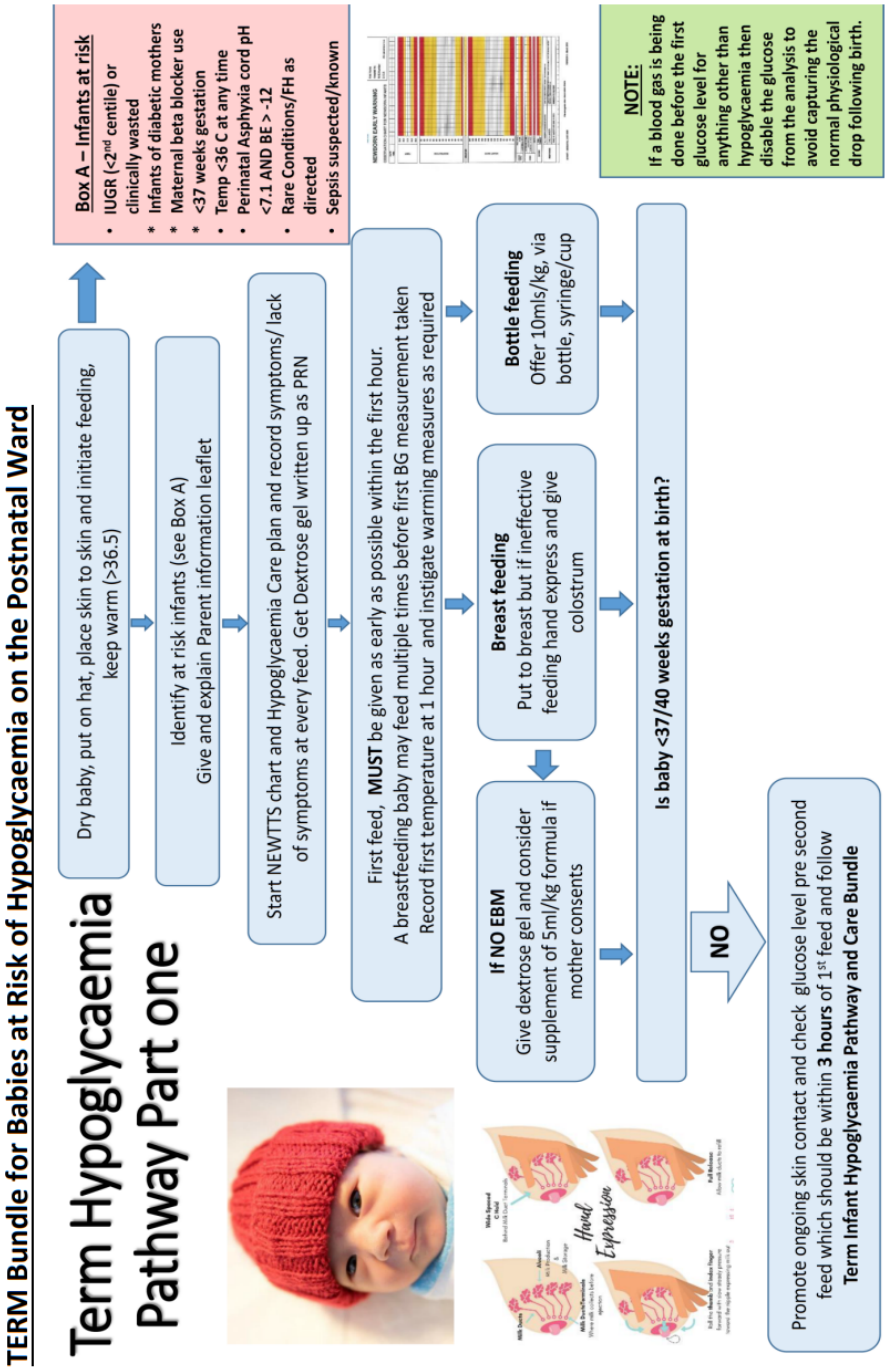
1. **In Term Baby**

- TERM Infants Hypoglycaemia Pathway Part ONE and TERM Infants Hypoglycaemia Pathway Part TWO (See Appendix 1)
- Hypoglycaemia Care Plan for Babies at risk of Hypoglycaemia following birth (See Appendix 3)
- NEWTT2 chart
- Buccal dextrose gel administration Guide (See Appendix 4).

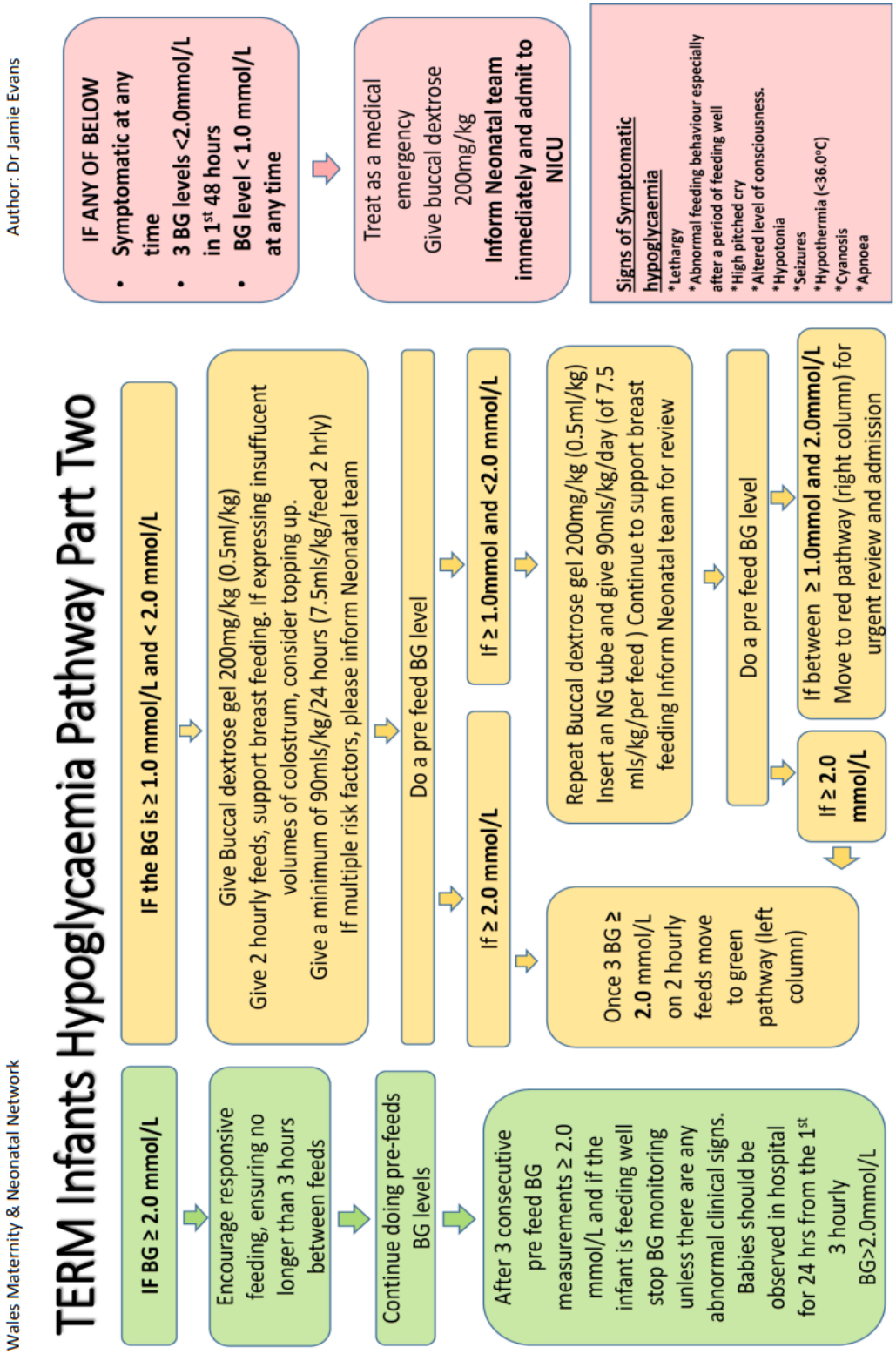
2. **In Preterm Baby**

- PRETERM Infants Hypoglycaemia Pathway Part ONE and PRETERM Infants Hypoglycaemia Pathway Part TWO (See Appendix 2)
- Hypoglycaemia Care Plan for Babies at risk of Hypoglycaemia following birth (See Appendix 3)
- NEWTT2 chart
- Buccal dextrose gel administration Guide (See Appendix 4).

Appendix 1 - TERM Bundle for Babies at Risk of Hypoglycaemia on the Postnatal Ward –
TERM Infants Hypoglycaemia Pathway Part ONE

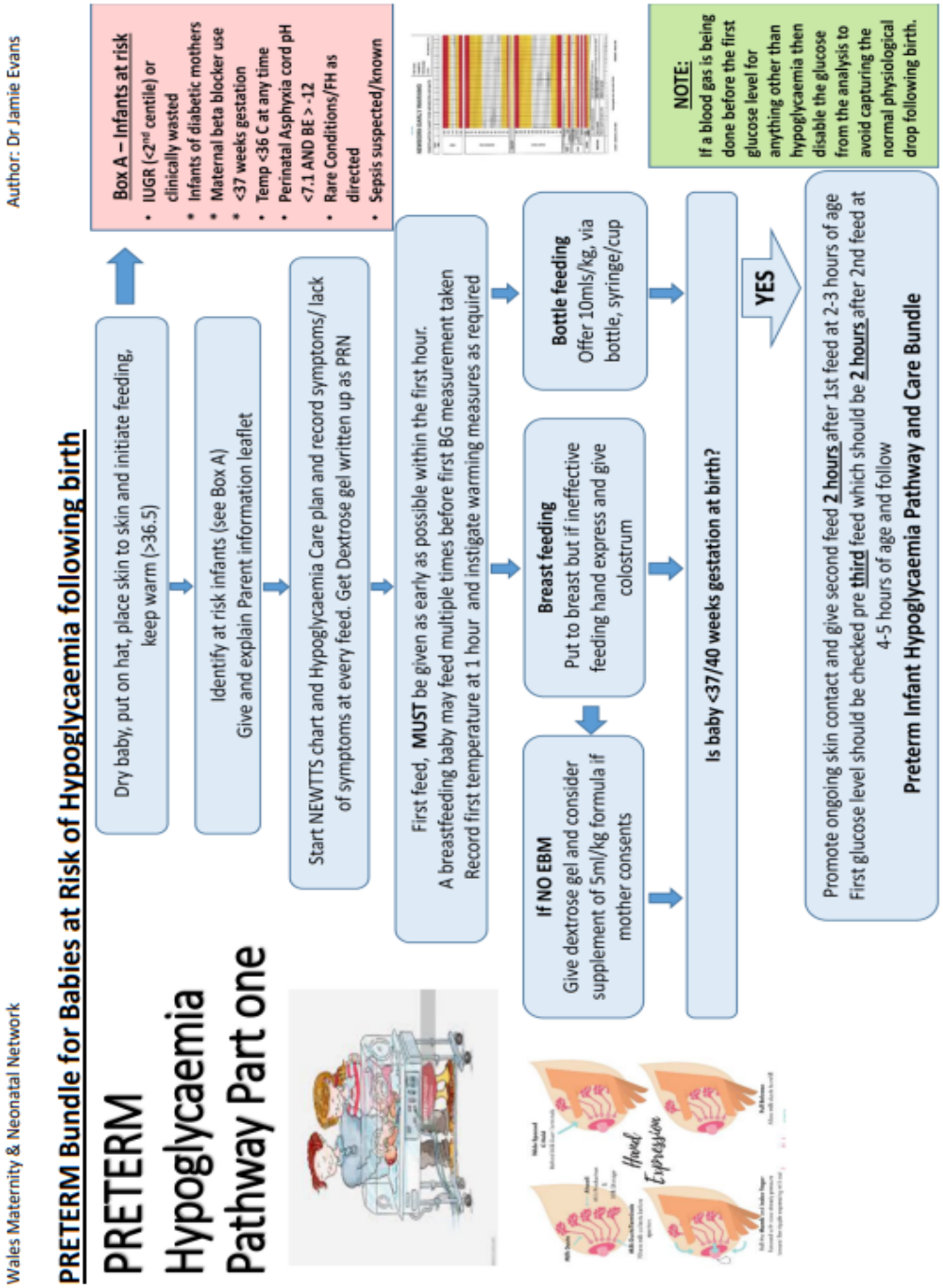


TERM Infants Hypoglycaemia Pathway Part Two

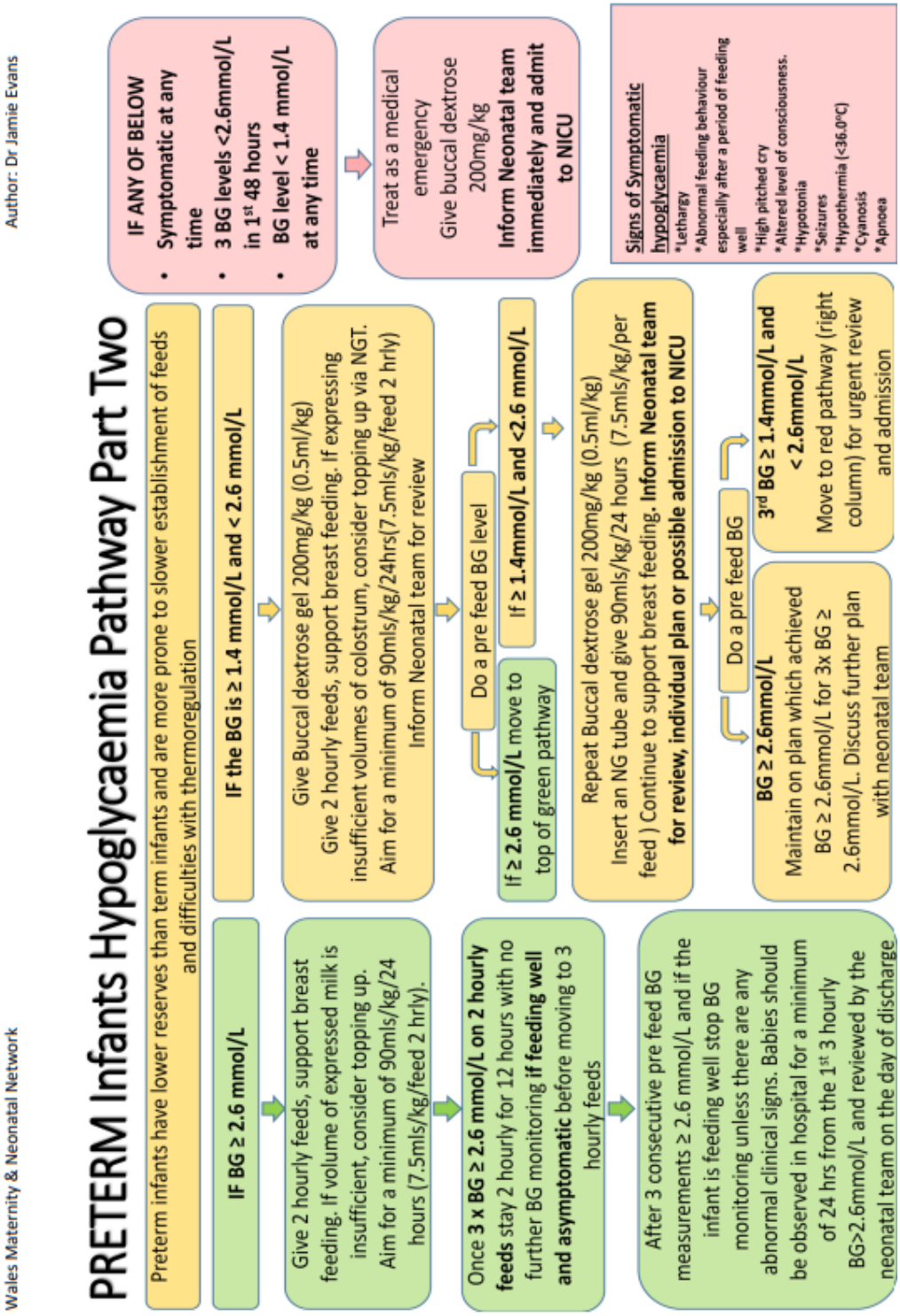


Appendix 2 - PRETERM Bundle for Babies at Risk of Hypoglycaemia following birth.

PRETERM Hypoglycaemia Pathway Part One:



PRETERM Hypoglycaemia Pathway Part TWO



Appendix 3 - Hypoglycaemia Care Plan for Babies at risk of hypoglycaemia following birth

Hywel Dda Hypoglycaemia Care Plan for babies at risk of hypoglycaemia following birth

Ensure NEWTT2 chart is completed for each assessment including TONE, COLOUR, RESPIRATORY RATE, HEART RATE, RESPONSIVENESS, TEMPERATURE.

RISK FACTORS FOR HYPOGLYCAEMIA -Please tick all that apply	
IUGR (<2nd centile)	
Infant of IDDM or GDM	
BW>98th centile/ macrosomic (in baby if IDDM?GDM mother	
Maternal betablockers in 3rd trimester or time of birth	
Preterm<37 weeks	
Preterm<36 weeks	
Baby with hypothermia (<36 degrees at any time)	
Perinatal asphyxia (<36 degrees at any time)	
Baby with suspected/known sepsis	
Other risk factors- genetic or FH	

Addressograph

Date and time of birth:

Feeding and Blood Glucose monitoring **Date :**

Time	Route of feeding NGT/bottle/Breast	Duration of feed	Type of milk	Volume	Vomit?	PU	BO	Blood glucose	signed

Appendix 4 - Buccal dextrose gel administration

Buccal gel can be a useful adjunct for use in cases of hypoglycaemia both on the postnatal ward and on the neonatal/ Special Care Baby Unit.

It must be prescribed ad administered in the correct way.

Buccal dextrose gel administration

Inclusion Criteria

- Buccal Glucose must be used in conjunction with a feeding plan
- Infants >34+6 gestation and younger than 48 hours after birth
- ALL babies symptomatic of hypoglycaemia with BG <2.6mmol/L whilst arranging urgent review and admission as an emergency

TERM Infants (from 37 weeks gestation)

- Blood Glucose 1.0-1.9mmol/L in an infant with no abnormal signs
- Blood glucose <1.0mmol/L in babies whilst arranging urgent review

Exclusion Criteria

- Babies <35 weeks gestation
- Babies >48 hours of age

Dose

200mg/kg (0.5mls/kg) of 40% dextrose gel

In the event that Dextrose Gel has not been prescribed at birth and a dose is required, it may be given by the midwife as per the SOP so that the dose is not delayed in a hypoglycaemia baby. Use the chart below to determine the dose needed and inform neonatal team so that it can be prescribed on the medication chart.

Weight of Baby (kg)	Volume of Gel (ml)
1.5-1.99	1ml
2.0-2.99	1.5ml
3.0-3.99	2ml
4.0-4.99	2.5ml
5.0-5.99	3ml
6.0-6.99	3.5ml

Administration of buccal gel

Administration

Draw up using a 2.5 or 5ml oral enteral syringe
Dry oral mucosa gently with a gauze swab and gently squirt with syringe into the inner cheek and gently massage using latex free gloves

Failure to do the steps above will decrease the uptake of dextrose gel and render it useless.
Offer a feed (preferably breast milk) immediately after. Baby can also feed whilst dextrose gel is being drawn up.

More than three doses should be discussed with the neonatal team.

Up to six doses can be given on the postnatal ward.

Caveat

If given as a temporising measure for symptoms of hypoglycaemia the baby must be admitted to the neonatal unit even if when baby is seen by the paediatrician / neonatologist the symptoms of hypoglycaemia have resolved.

Appendix 5 - Patient information leaflet

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Appendix 1
Parent Information Leaflet for Babies at risk of Hypoglycaemia

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. You will know the result of the test straight away.

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

Authors: J Evans, E Smit, C Doherty, S Rowley, J Gray, J Rogers & A Lewis Review due: May 2024

"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 signs 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 36.50C and 37.50C 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 or [local number for urgent assessment]
- If you are really worried, take your baby to your nearest Paediatric A&E or dial 999. [Insert local information]

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, s/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 / Special Care Baby 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