

Prevention and Management of Symptomatic or Significant Hypoglycaemia in Neonates

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1. **Introduction & scope**

This guideline is aimed at all Health Care Professionals involved in the care of infants within the Perinatal Directorate.

This guideline was updated in 2018 to meet the British Association of Perinatal Medicine (BAPM) framework for practice; 'Identification and management of neonatal hypoglycaemia in the full term infant – A framework for practice' October 2017 ^[1] and further amended in 2022.

Aims

- To detect significant or symptomatic hypoglycaemia in infants at risk, AND to maximise:
 - Appropriate investigation and management of severe or symptomatic hypoglycaemia
 - To minimise inappropriate blood taking of term infants
 - To ensure babies born 34-36+6 weeks who receive care in the postnatal ward setting have appropriate monitoring and thresholds of blood sugars

Key Links:

[Table 2: Infants who require blood glucose \(BG\) monitoring](#)

[Table 3: Birthweight on 2nd centile](#)

[Table 5: Investigations for neonatal hypoglycaemia \(blood bottles and urine tests\)](#)

Flowcharts for the Management of the Healthy Term Infant \geq 37 weeks

[Flowchart A. Management of term infants \$\geq\$ 37 weeks at risk of hypoglycaemia](#)

[Flowchart B. Pre-feed blood glucose 1 – 1.9 mmol/l and no abnormal clinical signs](#)

[Flowchart C. Blood glucose < 1mmol/l and / or clinical signs consistent with hypoglycaemia](#)

[Flowchart D. Management of Reluctant Feeding in healthy term infants \$\geq\$ 37 weeks](#)

[Management of term infants with hypoglycaemia](#)

Flowchart for the Management Preterm Infant with hypoglycaemia on the post natal wards

[Management of late preterm infants with hypoglycaemia](#)

Flowcharts for the Management of neonates on the Neonatal Unit

[Flowchart E. Management of Hypoglycaemia on the Neonatal Unit](#)

Appendices

[Appendix 1: Use of dextrose gel \(dose and administration\)](#)

[Appendix 2: Parent information](#)

1.1 Key Points – Glucose Monitoring

- **Do not** routinely monitor Blood Glucose (BG) in healthy appropriately grown term infants ^[2]
- Most healthy term neonates **do not** develop “symptomatic hypoglycaemia” as a consequence of underfeeding ^[3]
- Term infants at risk of impaired metabolic adaptation and hypoglycaemia should be identified at birth and placed on a care pathway that includes early provision of energy, regular assessment of feeding and clinical condition and **pre-feed** BG monitoring - aim to maintain **BG ≥ 2.0mmol/l** ^[1]
- Infants at risk of impaired metabolic adaptation and hypoglycaemia include infants of diabetic mothers, infants whose mothers have taken beta-blockers, large for gestational age infants (birthweight > 4.5kg), infants with intrauterine growth restriction (IUGR – birthweight < 2nd centile) preterm infants, and those screened for sepsis.

1.2 Key Points – Treatment of Hypoglycaemia in term infants

- Urgent medical review and intervention for term infants with:
 - A BG value <1.0mmol/l at any time
 - A single BG value <2.6mmol/l in a neonate with abnormal clinical signs
 - A BG value <2.0mmol/l and remaining <2.0mmol/l at next measurement in a baby with a risk factor for impaired metabolic adaptation and hypoglycaemia but without abnormal clinical signs.
- Buccal dextrose gel may be used in conjunction with a feeding plan when the blood glucose is <2.0mmol/l.
- Severe (BG < 1.0mmol/l) or recurrent hypoglycaemia (three or more measurements < 2.0 mmol/l in first 48 hours after birth) requires urgent medical review, investigation and intervention.
- Parents are partners in the care of infants at risk of impaired metabolic adaptation and hypoglycaemia. Parents should be given verbal and written information (please see appendix for leaflet) that describes why their baby is receiving extra support and BG monitoring; how to reduce the likelihood of hypoglycaemia; the signs that indicate when a baby is becoming unwell; and how to raise concerns about their baby's well-being or feeding pattern.

2. Hypoglycaemia prevention & management

2.1 Background

Transient hypoglycaemia occurs as a normal physiological event following delivery but persistent significant hypoglycaemia can result in brain injury and long-term neurodevelopmental impairment. Persistent significant hypoglycaemia can result in damage to the occipital lobes and consequent cortical blindness^[7, 8]. Middle cerebral artery infarction and basal ganglia/thalamic abnormalities have also been described^[9]. Hypoglycaemia is the leading cause of admission of term infants to neonatal units in England. However, studies have shown that in over 50% of the admissions the BG value was $\geq 2.0\text{mmol/l}$ ^[1]. This results in unnecessary separation of mother and baby.

There is great variation amongst neonatal units in the definition of hypoglycaemia and thresholds for intervention. To promote safer practices and avoid unnecessary intervention and separation of mother and baby, NHS Improvement and British Association of Perinatal Medicine (BAPM) developed an evidence based Framework for Practice (FfP)^[1] to address variation in practices in the identification, management and admission thresholds of term babies admitted to neonatal units for hypoglycaemia and to promote safer practices that avoid unnecessary separation of mother and baby. The UHL guideline has been updated in 2022 to meet this national guidance.

The exact definition of clinically important hypoglycaemia has long been debated^[10]

Normal blood sugar levels

A BG level $\geq 2.6\text{mmol/l}$ and showing no signs of hypoglycaemia is generally accepted as normal

In well term infants (≥ 37 weeks) a target of $\geq 2.0\text{mmol/l}$ is acceptable. In late pre-terms this should be $\geq 2.6\text{mmol/l}$.

In unwell term admitted to the neonatal unit and preterm infants <37 weeks, aim for BG $\geq 2.6\text{mmol/l}$.

Significant Hypoglycaemia

A BG level $< 1.0\text{mmol/l}$ is **always** considered significant^[4]

2.2 Causes of hypoglycaemia in newborn

Table 1: Causes of hypoglycaemia in newborn

Poor glucose stores/producti on	Increased glucose demand	Hyperinsulinaemia	Not enough anti-insulin hormones
IUGR infants	Hypothermia	Infant of diabetic	Pituitary insufficiency
Preterm infants	Severe rhesus	Islet cell disorders	Adrenocortic al deficiency
Fluid restricted infants	Septicaemia	Maternal drugs: beta blocker e.g.	
Moderate – Severe birth	Respiratory distress	Beckwith Wiedemann	
Inborn errors of metabolism	Seizures		
Midline defects	Polycythaemia		

Table 2: Infants who require BG monitoring

Preterm infants (< 37 weeks)
Intrauterine growth restriction (birth weight < 2nd centile)
Infants of diabetic mothers (Type I & II Diabetes and Gestational Diabetes Mellitus)
Maternal drugs: beta-blockers e.g. labetalol in third trimester or at the time of delivery
Large for gestational age (birth weight > 4.5kg)
Babies screened for sepsis

Table 3: Birthweight in kg on 2nd centile

Gestational age / weeks	Boys	Girls
37	2.10	2.00
37 + 4	2.20	2.10
38	2.30	2.20
38 + 4	2.40	2.30
39	2.50	2.45
40	2.65	2.60
41	2.80	2.75
42	2.90	2.85

In addition to the above list, consider BG in infants with any of the following diagnoses:

- Perinatal stress such as hypoxic-ischaemia. Perinatal acidosis (cord arterial or infant pH <7.1 and base deficit ≤-12mmol/l)
- Respiratory distress
- Meconium aspiration syndrome
- Hypothermia (<36.5 C) (independent significant risk factor)
- Symptomatic polycythaemia

2.3 Symptoms of Hypoglycaemia

Infants may manifest neuroglycopenic signs and symptoms when BG level is low. These can be subtle and are often non-specific. As these infants are at risk of poor neurological outcome, it is vital that such signs/symptoms are treated. If truly caused by hypoglycaemia, such signs are relatively easily and quickly reversed by normalisation of BG levels.

Symptoms of hypoglycaemia:

- Altered level of consciousness: Coma, lethargy, hypotonia, stupor, irritability
- Hypothermia
- Apnoea,
- High pitched cry
- Cyanosis, pallor
- Abnormal feeding behaviour after previously feeding well
- Seizures, tremor and jitteriness
(Jitteriness - excessive repetitive movements of one or more limbs, which is unprovoked and not in response to a stimulus)

Abnormal feeding behaviour (not waking for feeds, not sucking effectively, appearing unsettled and demanding very frequent feeds), especially after a period of feeding well may be indicative of hypoglycaemia. It should prompt a full clinical assessment and consideration of BG measurement.

2.4 Measurement of blood glucose in the newborn

Accurate measurement of blood glucose level is essential for diagnosis and management of neonatal hypoglycaemia.

As recommended by BAPM ^[1], ward-based blood gas machine should be used for measuring blood glucose as they will produce more accurate and quick BG results that correlate with laboratory plasma glucose results in the majority of cases.

If handheld glucometers are being used to screen for low BG, only those devices conforming to the ISO15197:2013 standard should be used and their limitations should be understood: possible error of +/-0.8mmol/l for values < 5.5mmol/l. All current cot side technologies are prone to some inaccuracy, particularly in the range 0 - 2.0mmol/l. If a BG result < 2.0mmols/l is obtained using a handheld glucometer, **recheck** the result immediately using blood gas machine or the laboratory BG provided baby's clinical condition allows this. Do not delay treatment for hypoglycaemia while awaiting laboratory BG results.

3. Management of term infants (≥ 37 weeks) with hypoglycaemia

3.1 Management on Delivery suite/Postnatal wards:

- Ensure the baby is kept warm after birth and has skin-to-skin contact with the mother to provide warmth and to facilitate the initiation of feeding.
- Ensure that baby is offered the breast/milk within the first 60 minutes.
- Do not allow more than three hours to pass between feeds, until blood glucose measurements have been above 2.0mmol/l on two consecutive occasions.
- Measure the blood glucose level before the second feed (2-4 hours after birth). Measure blood glucose immediately if there are clinical signs suggestive of hypoglycaemia.
- If the first BG is 1.0 - 1.9mmol/l, 40% buccal dextrose gel (0.5ml/kg) may be given alongside feeding support: on-going help with feeding; hand expression; recognition of early feeding cues and signs of effective attachment and feeding. For women who chose to formula feed, give 10-15ml/kg (80-100ml/kg/d) per feed 3 hourly over the first 24 hours after birth.
- If BG <1.0mmol/l, arrange for urgent medical review which will include siting an intravenous cannula for treatment with IV glucose.
- If BG is <1.0mmol/l, 40% buccal dextrose gel should only be used as an interim measure while arranging for treatment with IV glucose.
- Do not transfer 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 ≥ 2.0mmol/l on at least two consecutive occasions and is feeding well. Infants at risk of hypoglycaemia should not be transferred to the community until they are at least 24 hours old.

3.2 Management on Neonatal unit (NNU)

In unwell term and preterm infants admitted to the NNU, aim for BG ≥ 2.6mmols/l.

- If blood glucose is between 1 - 1.9mmol/l and has not improved following breast feeding support and/or bottle/cup top up or infant not taking adequate amount of milk orally but tolerating enteral feeds, consider siting nasogastric tube and providing full enteral feeds via nasogastric tube.
- If the blood glucose level is less than 1.0mmol/l, give a bolus of 2.5mls/kg 10% glucose and immediately start an intravenous infusion of 10% glucose at 75mls/kg/day or 100mls/kg if BW <1kg . Recheck the blood sugar after 60mins

- If the repeat blood sugar remains <1.0mmol/l ensure that the baby is receiving the glucose infusion. Check that the cannula/UVC is functioning and not blocked/dislodged/extravasated.
- If the blood sugar is < 2.6mmol/l but increasing, there a short period of observation with frequent blood sugars (30mins to hourly until the blood sugar is ≥ 2.6 mmol/l and stable). If the blood sugar is failing to increase to ≥ 2.6 mmol/l then increase the volume or concentration of glucose infusion.
- Aim to start parenteral nutrition as soon as possible.
- If the repeat blood sugar remains <1.0mmol/l repeat the glucose bolus and increase the glucose delivery by 2mg/kg/min by increasing the volume or concentration of glucose infusion.
- 10% and 12.5% glucose solution can be given peripherally but a higher concentration of glucose (15%, 20%) can only be given via a central venous line. Consider getting a central venous access early (UVC or peripheral long line).
- If glucose utilisation is >8mg/kg/min, consider hyperinsulinaemic hypoglycaemia (see section 9).

Calculation of glucose delivery rates:

Normal glucose utilisation rates are 4-6mg/kg/min. Infants in the high-risk groups or those with other pathologies frequently require 6-10mg/kg/min.

$$\text{Glucose delivery} = \frac{(\text{ml/hr infusion rate}) \times (\% \text{ Glucose Infusion}) \times 10}{(\text{weight in kg}) \times 60}$$

Table 4: Glucose delivery rate

Rate of glucose delivery (mg/kg/min)				
Strength of IV glucose	10%	12.5%	15%	20%
Fluid infusion rate				
60	4.2	5.2	6.3	8.3
90	6.3	7.8	9.4	12.
100	6.9	8.7	10.4	13.9
120	8.3	10.4	12.5	16.7
150	10	13	15.6	20.8

*15% and 20% glucose solutions must be delivered via a central line
Glucose delivery rates in white (in black boxes) indicate the need for investigating for

4. Management of preterm infants (<37 weeks) with hypoglycaemia

Preterm neonates are predisposed to developing hypoglycaemia due to their limited glycogen and fat stores, higher metabolic demands due to a relatively larger brain size, and are unable to mount a counter-regulatory response to hypoglycaemia with an inability to generate new glucose using gluconeogenesis pathways.

The management of preterm infants with hypoglycaemia is related to their gestation and other comorbidities:

'Late preterm' infants (34 to 36 week infants) cared for on the postnatal wards Should have a target BG ≥ 2.6 mmol/l. The management can still follow the same steps; however the target BG level is higher. There is guidance on the management of late preterm flowsheet.

For all other preterm infants use Flowchart E. Management of Hypoglycaemia on the Neonatal Unit

Hyperglycaemia is more common in preterm infants (see hyperglycaemia guideline)

5. Weaning From IV Glucose

The aim of effective weaning from IV glucose is to prevent hypoglycaemic episodes but also to prevent excessive glucose monitoring. This weaning plan will not be applicable to infants with hyperinsulinaemic hypoglycaemia.

5.1 Breast or Bottle Fed Infants

A well term infant in whom hypoglycaemia has resolved, demand feeding can be established and IV 10% glucose can be reduced quite quickly:

- Decrease the glucose concentration from 20% to 15% to 10% as tolerated before decreasing the volume
- Halve and then stop glucose infusion if BG maintained but if this is not possible
- Decrease by 1-2 ml every 4-6 hours as long as the glucose is ≥ 2.6 mmol/l
- Check a pre-feed BG (before next feed) after any decrease in IV glucose infusion rate to ensure the change is tolerated
- Ensure that a blood glucose is measured pre-feed once the IV has stopped

5.2 Infant Establishing Nasogastric (NG) Feeds

Once the infant is able to tolerate increased volume of nasogastric feeds

- Increase the NG feeds and decrease the IV by 1-2 ml every 4-6 hours as long as the glucose is maintained ≥ 2.6 mmol/l
- Check a pre-feed BG (before next feed) following decrease in IV glucose infusion
- Continue to feed 2 hourly by NG until the IV has stopped
- Check pre-feed blood glucose once the IV has stopped
- Thereafter increase time between feeds and normalise to either breast feeding or bottle feeds as per maternal preference

6. Investigations for hypoglycaemia

Transient hypoglycaemia defined as ONE measurement of 1.0 - 1.9 mmol/l within the first 48 hours after birth in a term infant with NO abnormal signs who is feeding effectively does not require investigation ^[1] (as in Table 2) or if the infant has hypoglycaemic encephalopathy with abnormal neurological signs, admit the infant to NNU for neurocritical care, investigation and treatment of the underlying cause of hypoglycaemia. **Investigations should be undertaken when the BG levels are low.**

Indication for investigation for neonatal hypoglycaemia

- Persistent hypoglycaemia: 3 or more recurrent BG <2.0mmol/l within the first 48 hours after birth
- Severe hypoglycaemia: BG <1.0mmol/l at any time
- Symptomatic hypoglycaemia: BG <2.6mmol/l with signs/symptoms of hypoglycaemia
- Infants with a glucose utilisation of >8mg/kg/min

Undertake thorough clinical examination of the baby from head to toe looking for any dysmorphic features such as coloboma, cleft palate, congenital heart disease, exomphalos, organomegaly, ambiguous genitalia. Consider evaluation for early onset sepsis.

Neonatal hypoglycaemia screen

Please re-fill box with the correct bottles

EMERGENCY BLOODS			
Test	Container	Volume	On ICE in 30min
Glucose	Yellow (fluoride)	0.5ml	
Insulin	White (serum)	0.5ml separate bottle	
C -Peptide	White (serum)	0.5ml separate bottle	
Free fatty acids B-hydroxybutyrate	Yellow (fluoride)	1ml	
Ammonia	Orange (lithium)	1ml	YES
Cortisol Growth hormone	White (serum)	1ml	
Lactate	On the gas	0.1ml	
NON EMERGENCY BLOODS			
Test	Container	Volume	
Plasma amino acids Carnitine total&free	Orange (lithium)	1ml	
Acyl-carnitine	Guthree	4 spots	
Urine reducing substances Urine organic acids Urine ketones	Universal container 1 st urine sample following hypoglycaemia episode	5ml	

Total: 2 orange/2 yeellow/3 white/1 universal container/1 Guthree

Table 5: Investigations for neonatal hypoglycaemia

Consider:

- Ophthalmology examination
- Cranial USS or Brain MRI – for suspected septo-optic dysplasia

Further investigations should be based on the results of the initial screen and taken following specialist advice.

6.1 Persistent low blood glucose measurement

Persistent hypoglycaemia can be the first sign of hyperinsulinism or another metabolic disorder. Early detection of this group of infants is important because specific interventions designed to reduce the risk of brain injury may be required along with specific long-term treatment and management.

Hyperinsulinaemic hypoglycaemia (HH, or 'hyperinsulinism') should be considered if:

- BG <2.0mmol/l on three or more occasions in first 48 hours despite adequate energy provision and a feeding plan
- Symptomatic hypoglycaemia
- If a glucose utilisation is greater than 8mg/kg/min

These cases must be discussed with the Duty Neonatal Consultant and a referral to the Paediatric Endocrinology team should be considered.

HH is a heterogeneous condition caused by dysregulation of insulin secretion from pancreatic beta cells. This condition is associated with several recognisable syndromes and disorders:

- Maternal diabetes
- Erythroblastosis (e.g. severe Rhesus disease)
- Insulinoma or Neonatal Hyperinsulinaemic Hypoglycaemia (nesidioblastosis)
- Beckwith-Wiedemann Syndrome
- Turner's Syndrome
- Soto's Syndrome
- Costello Syndrome
- Prader-Willi Syndrome

Other causes of persistent hypoglycaemia include:

1. Endocrine Causes
 - Panhypopituitarism
 - Hypothyroidism
 - Growth hormone deficiency
 - ACTH unresponsiveness
2. Inborn Errors of Metabolism
 - Carbohydrate metabolism: Galactosaemia, Glycogen Storage Disease, Fructose Intolerance
 - Amino Acid metabolism: Maple Syrup Urine Disease, Propionicacidaemia, Methylmalonicacidaemia, Hereditary Tyrosinaemia

Sometimes there may be diagnostic clues such as hyperpigmentation of the skin suggesting the diagnosis of familial glucocorticoid deficiency (FGD) or ambiguous genitalia, but no other signs may be present and extensive laboratory evaluation is required, guided by specialist advice.

If HH is suspected, diagnosis should be made promptly by confirming high plasma insulin levels and BG levels should be maintained > 3.0mmol/l (unless specialist advice has been sought).

Table 6: Treatment of hyperinsulinaemic hypoglycaemia
(Also accessible via monograph held on BadgerNet)

Drug	Dose
Diazoxide	Total daily dose up to 20 mg/kg/day in 2 – 3 divided doses, in combination with a thiazide diuretic.
Hydrochlorothiazide	Total daily dose up to 7.5 mg/kg/day in 2 divided doses.
Chlorothiazide	Total daily dose up to 10 mg/kg/day in 2 divided doses.
Octreotide	10 micrograms/kg/day as a continuous infusion.
Glucagon infusion	5microgram/kg/hour by infusion.variable dosage

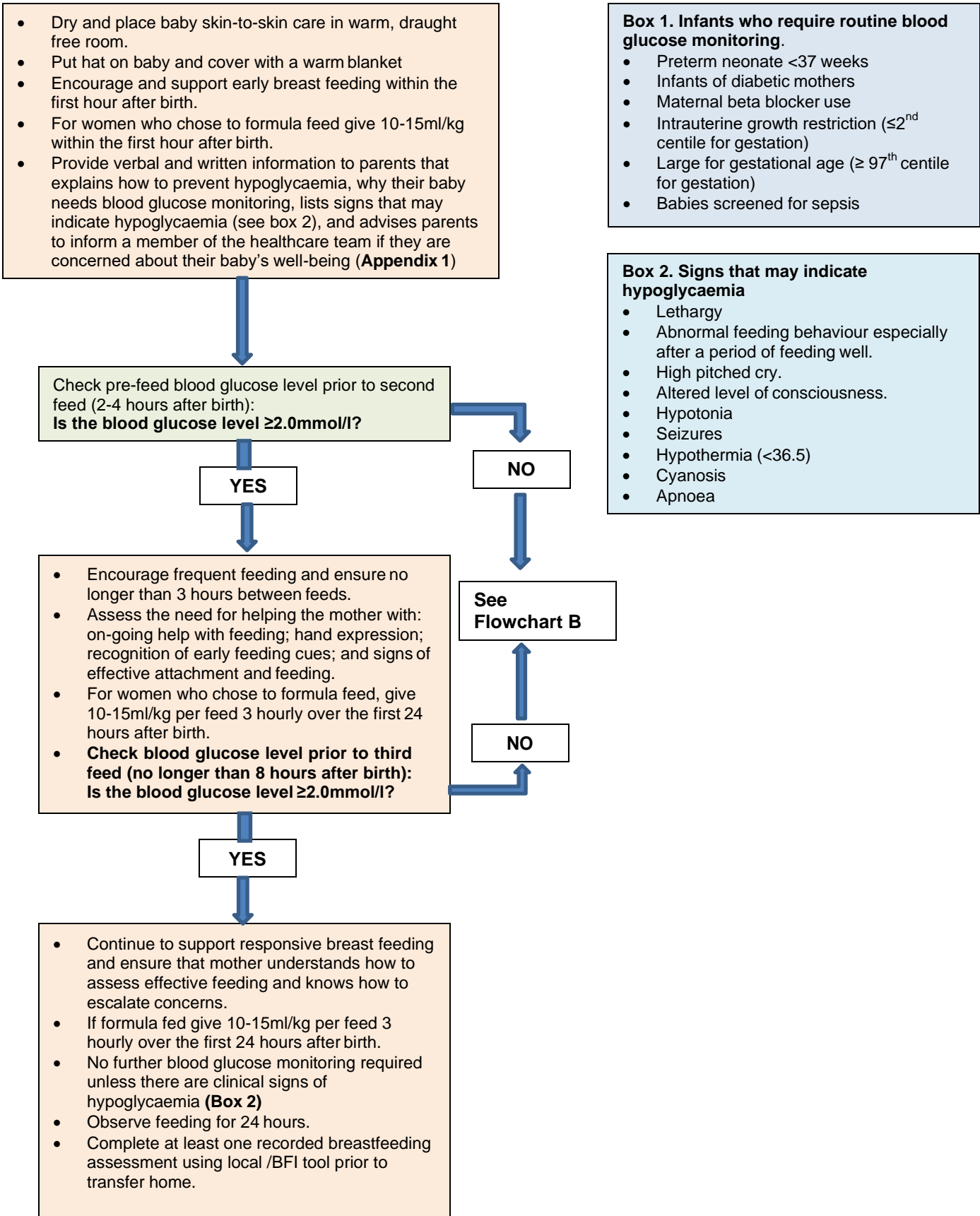
Diazoxide can cause both sodium and water retention causing a potential risk of both hyponatraemia or hypernatraemia and pulmonary hypertension. Strict monitoring of fluid balance is required. Chlorthiazide is given alongside diazoxide to reduce the risk of fluid retention, as well as potentiating its glycaemic effect. Referral by the Paediatric Endocrinologist to a centre skilled in the management of these conditions may be required.

7. Documentation

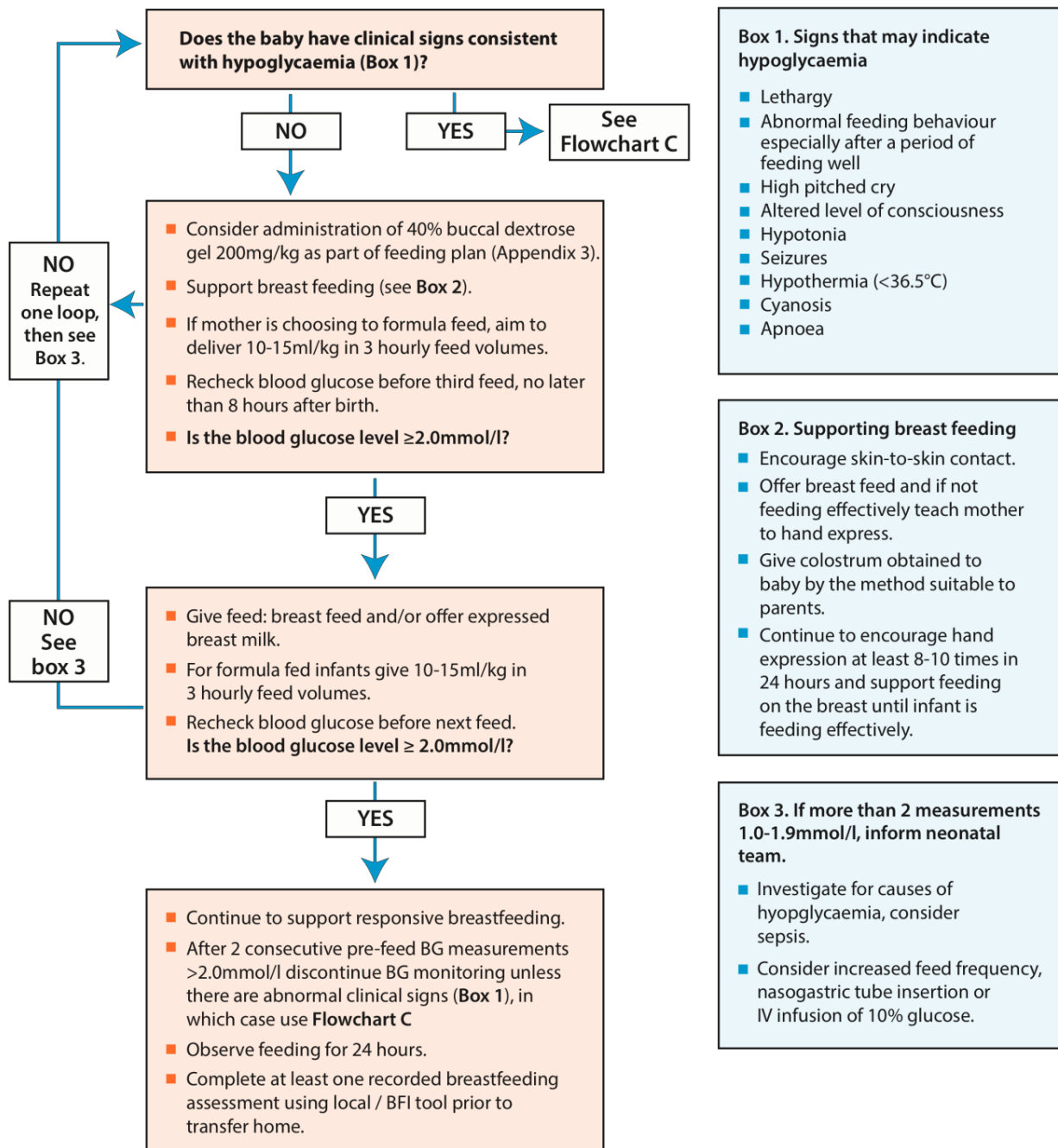
Neonatal hypoglycaemia may be an early sign of other significant disease processes, which will require further investigation. It is also becoming an important aspect in medico-legal cases involving babies. For these reasons, make accurate contemporaneous documentation of events, containing the following in baby’s clinical case notes.

- Time when hypoglycaemia was noted
- Infant’s clinical condition when hypoglycaemia noted
- Blood glucose concentration - noting the method by which it was measured
- Nature of treatment instituted
- Nature and timing of the clinical response to treatment
- Confirmation of improvement in blood glucose

Flowchart A. Management of term infants ≥ 37 weeks at risk of hypoglycaemia

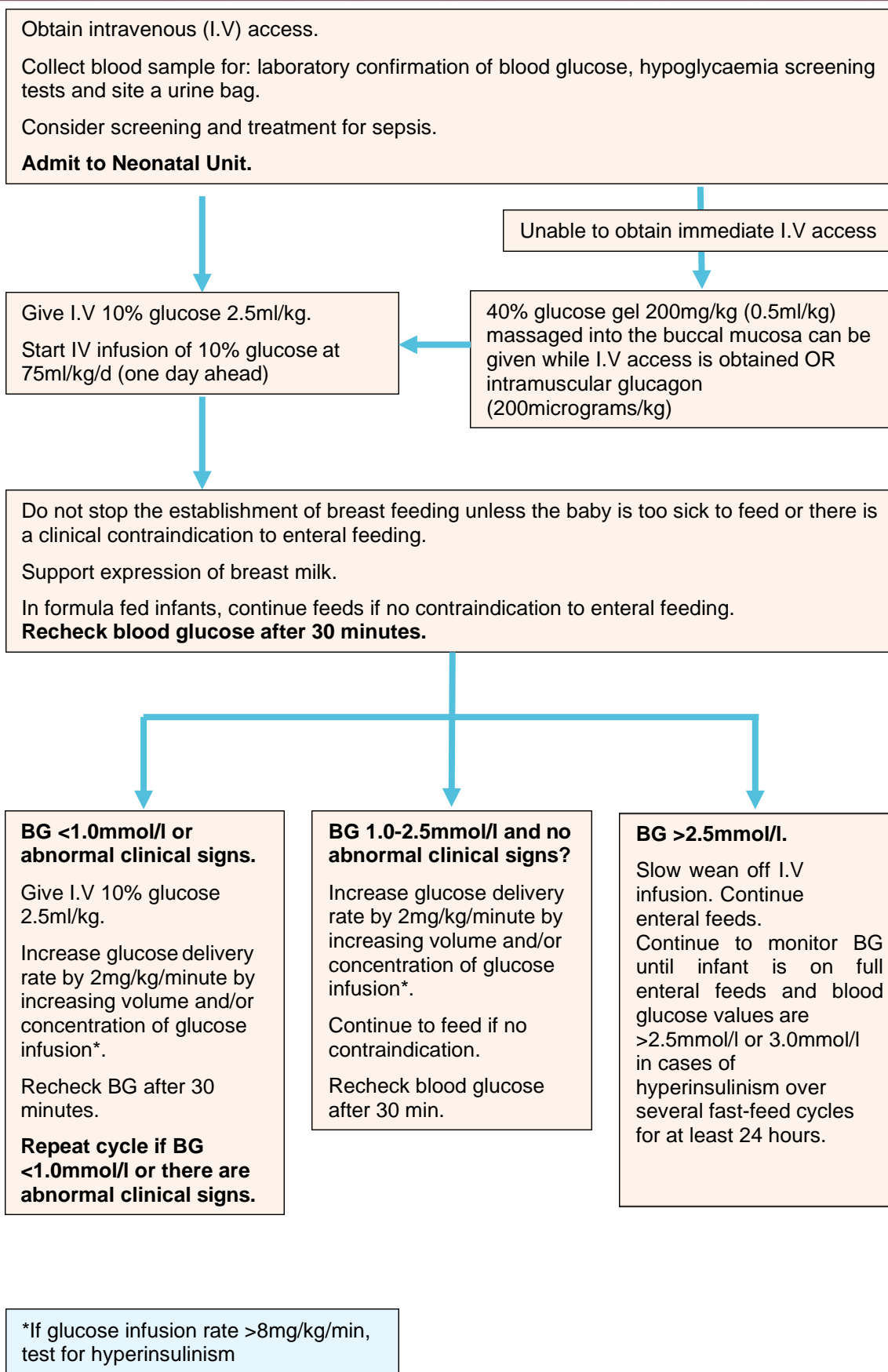


Flowchart B. Pre-feed BG 1.0 – 1.9mmol/l and no abnormal clinical signs

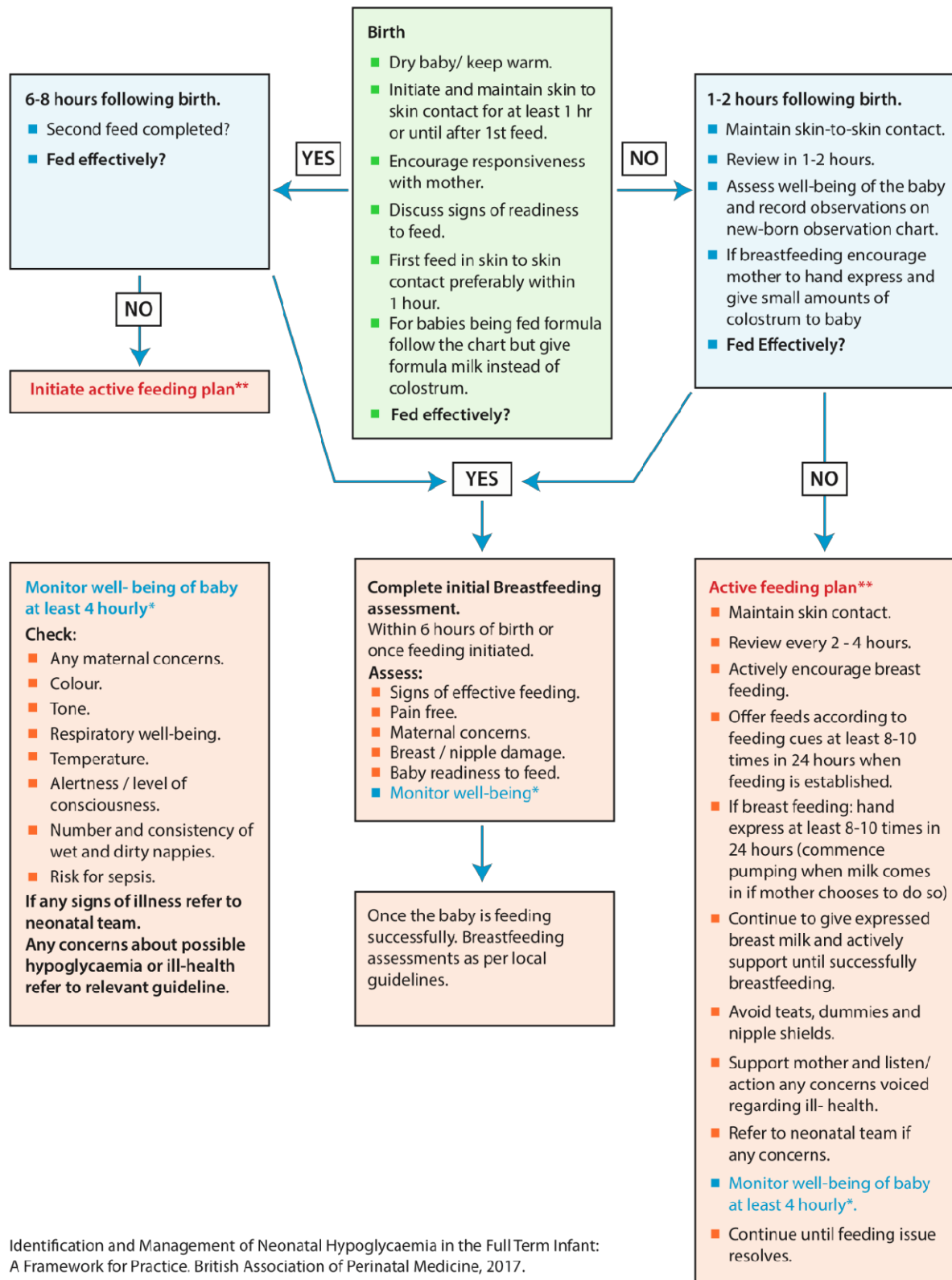


Identification and Management of Neonatal Hypoglycaemia in the Full Term Infant: A Framework for Practice. British Association of Perinatal Medicine, 2017.

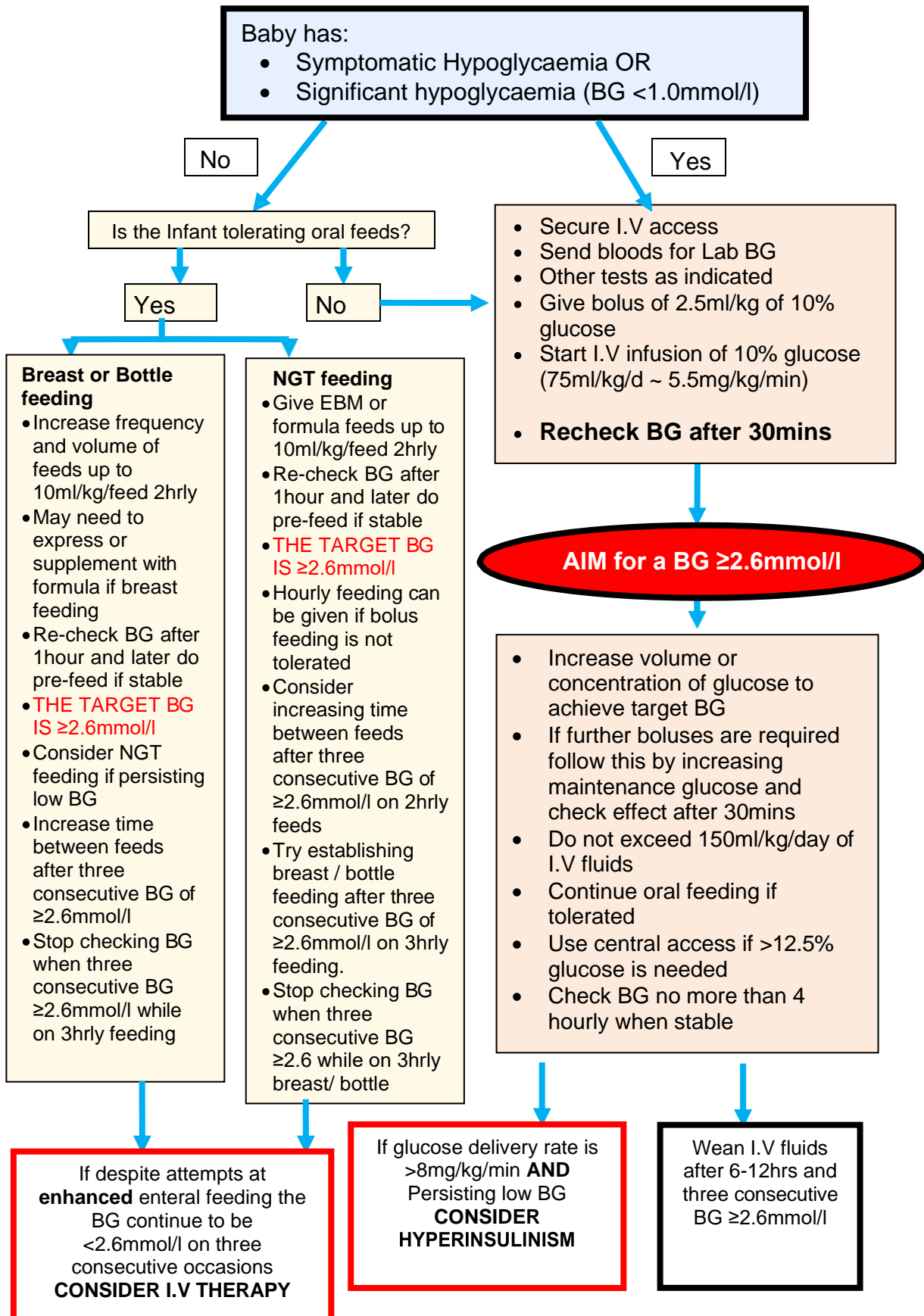
Flowchart C. Blood glucose < 1.0mmol/l and / or clinical signs consistent with hypoglycaemia



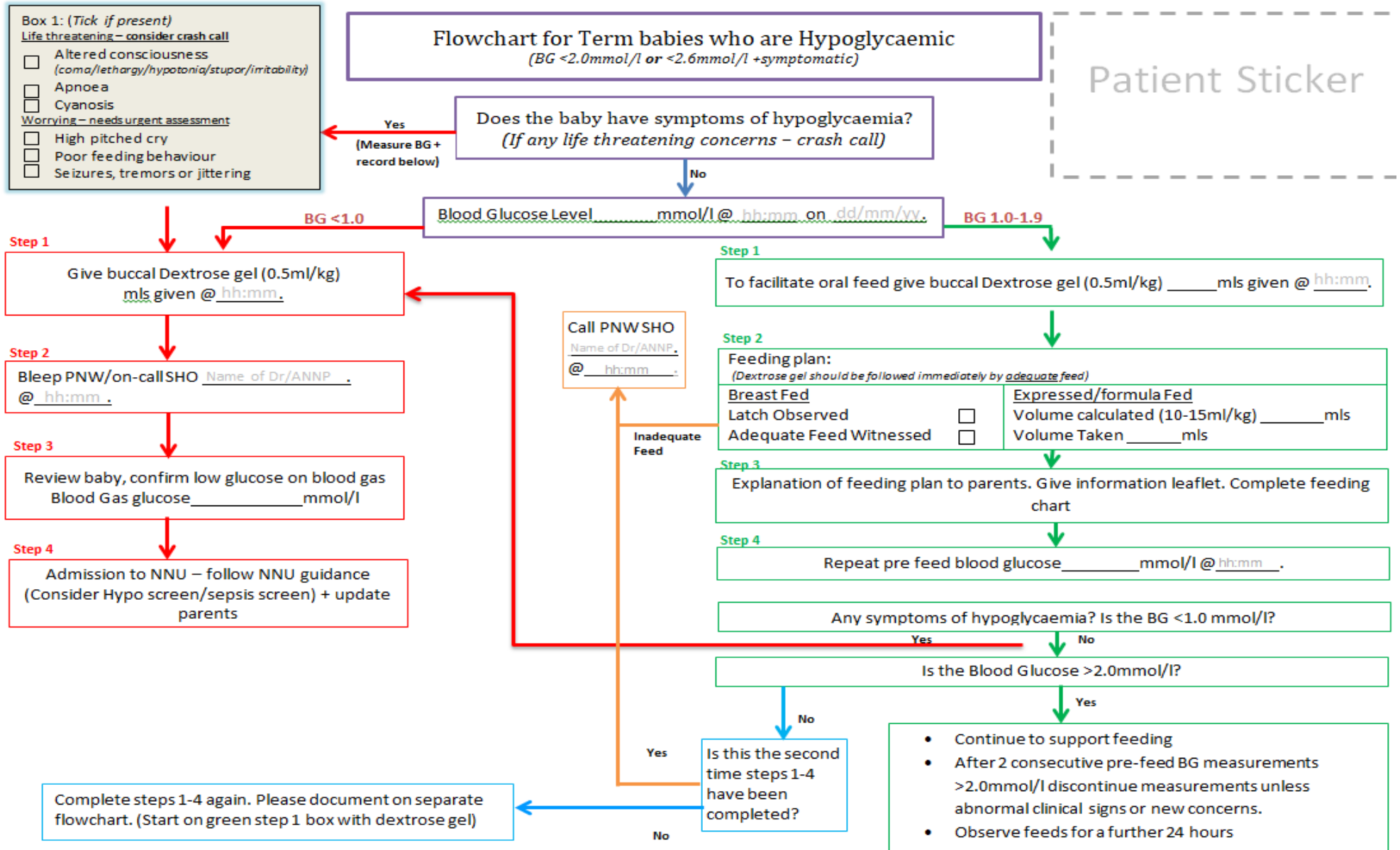
Flowchart D. Management of reluctant feeding in healthy term infants ≥ 37 weeks



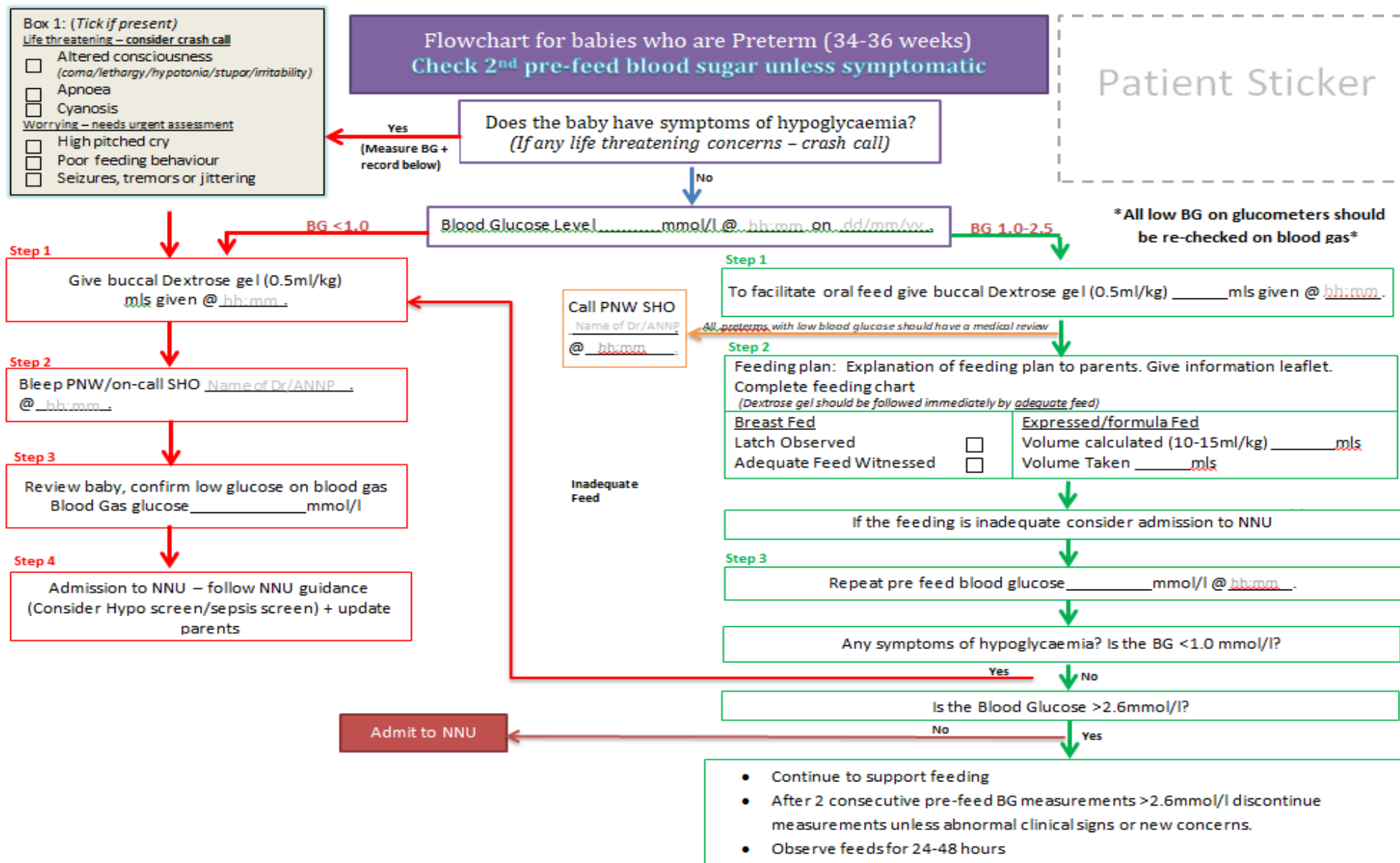
Flowchart E. Management of Hypoglycaemia on the Neonatal Unit



Management of term babies on the post natal ward who are hypoglycaemic



Management of late pre-term babies on the post natal ward who are hypoglycaemic



8. Education and Training

None

9. Monitoring Compliance

1. Infants of Diabetic Mothers and term babies with birth weight < 2nd centile or >4.5kg are identified at birth, screened and managed to prevent hypoglycaemia (100% target)
2. Infants admitted to NNU with significant or symptomatic hypoglycaemia are managed according to the guideline.

10. Supporting References

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11. Key Words

Blood glucose, Feeding, Hyperinsulinaemia, Monitoring

The Trust recognises the diversity of the local community it serves. Our aim therefore is to provide a safe environment free from discrimination and treat all individuals fairly with dignity and appropriately according to their needs. As part of its development, this policy and its impact on equality have been reviewed and no detriment was identified.

Contact and review details			
Guideline Lead (Name and Title) Author: Kamini Yadav, Consultant Neonatologist Contact: S Mittal, Consultant - Clinical Guidelines Lead			Executive Lead Chief Nurse
Details of Changes made during review:			
Date	Issue Number	Reviewed By	Description Of Changes (If Any)
1/4/2008	2	M. Meeks	Guideline review
6/12/2011	3	Neonatal Guidelines Meeting	ratified
10/4/2012	3	Maternity Governance group	
16/10/2012	4	Neonatal Governance	ratified
3/12/2013	5	Neonatal Guidelines Meeting	ratified after modifications
2017	6	LB. KY	Substantial rewrite in light of BAPM framework for practice
Feb 2018 July 2018 Oct 2018	7	Neonatal Guidelines Meeting Neonatal Governance	
Oct 2018 - Jan 2019	7	Maternity Guidelines and Governance	
April 2022 May 2022 June 2022	8	Neonatal Guideline Meeting Neonatal Governance Meeting Maternity guidelines Maternity Governance	Changes to previous guideline include the addition of new flow charts for the management of hypoglycaemia in term and late pre-term babies on the PN wards. Blood glucose monitoring should be considered in babies screened for sepsis.
December 2024	9	Neonatal Guideline Meeting Neonatal Governance Meeting	Updated the neonatal hypoglycaemia screen table.

Appendix 1: Use of dextrose gel

Indications:

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

Note:

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 of 40% 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 2: Parent information

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 hypoglycemia).

Babies who are small, premature, unwell at birth, whose mothers are diabetic or have taken certain medication (beta-blockers) or very big babies, 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 they are in hospital. Keep your baby in skin contact on your chest covered with a blanket and look into your baby’s eyes to check their 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 them 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 they are 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 they 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, they 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.

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 or sooner of clinically indicated.

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 they are happy that your baby is well, they 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.

The team may prescribe a dose of glucose (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, they 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 they are 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 they have 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 they show feeding cues and observe for signs that they want a break. Don't necessarily expect your baby to finish a bottle – let them take as much milk as they want.

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 3: Management of Preterm infants 34+0 – 36+6 weeks gestation on the postnatal ward

This appendix is to be used in conjunction with the guideline 'Prevention and management of symptomatic or significant hypoglycaemia in neonates'

This appendix applies to the management of late preterms 34+0 – 36+6 on the postnatal ward. This is an at-risk group, and their gestation should be taken into consideration when managing hypoglycaemia.

- Ensure the baby is kept warm after birth and has skin-to-skin contact with the mother to provide warmth and to facilitate the initiation of feeding.
- Ensure that baby is offered the breast/milk within the first 60 minutes.
- Do not allow more than three hours to pass between feeds, until blood glucose measurements have been above ≥ 2.6 mmol/l on two consecutive occasions.
- Measure the blood glucose level before the second feed (2-4 hours after birth). Measure blood glucose immediately if there are clinical signs suggestive of hypoglycaemia.
- If the first BG is 1.0 – 2.5mmol/l, 40% buccal dextrose gel (0.5ml/kg) may be given alongside feeding support: ongoing help with feeding; hand expression; recognition of early feeding cues and signs of effective attachment and feeding. For women who chose to formula feed, give 10-15ml/kg per feed 3 hourly over the first 24 hours after birth. All of these babies should have a timely medical review to consider whether early support is required.
- If BG < 1.0mmol/l, arrange for urgent medical review which will include siting an intravenous cannula for treatment with IV glucose.
- If BG is < 1.0mmol/l, 40% buccal dextrose gel should only be used as an interim measure while arranging for treatment with IV glucose.
- If the repeat BG is still < 2.6mmol/l, the baby should be considered for admission to the neonatal unit to support the establishment of feeding.

Please use the 'Flowchart for babies who are preterm (34-36 weeks)' to support documentation if the baby becomes hypoglycaemic. This should be stapled to the back of the NEWS chart.