# HYPOGLYCAEMIA (BIRTH–72 HR)

## USE GUIDELINE FOR:

- Well babies outside of NNU
- Babies in first 72 hr after birth during the period of metabolic transition
- Babies ≥37 weeks' gestation [guidance based on **Identification and Management of Neonatal Hypoglycaemia in the Full-Term Infant (Birth–72 hours) A Framework for Practice, British Association of Perinatal Medicine January 2024]**

- For babies $34^{+0}$–$36^{+6}$ weeks' gestation, this guideline can be used as an **adjunct** to, but **not as a replacement** for **Early Postnatal Care of the Moderate-Late Preterm Infant – A Framework for Practice, British Association of Perinatal Medicine January 2023**
- late preterm babies are 24 times more likely than term babies to develop hypoglycaemia, and require a feeding plan to ensure nutritional needs are met in addition to preventing hypoglycaemia

**Do NOT use this guideline for:**

- **Unwell babies or babies aged >72 hr**
- BAPM advise to increase acceptable blood glucose threshold to **3.5 mmol/L after 72 hr** after birth in babies >37 weeks' gestation
- no threshold provided by BAPM for babies ≤36 weeks' gestation

## INDICATIONS FOR BLOOD GLUCOSE MEASUREMENT

- **All babies with ≥1 risk factor** for hypoglycaemia require blood glucose measurement and management – see flowcharts below
- In addition to these risk factors for hypoglycaemia, measure blood glucose for other clinical indications including:
- presence of ≥1 of the following clinical signs/diagnoses:
  - perinatal acidosis (cord arterial or baby pH <7.1 and base deficit ≥-12 mmol/L)
  - hypothermia (<36.5°C) not attributable to environmental factors
  - suspected/confirmed early neonatal sepsis
  - central cyanosis
  - apnoea
  - altered level of consciousness
  - seizures
  - hypotonia
  - lethargy
  - high pitched cry
- Abnormal feeding behaviour **especially after a period of feeding well:**
- not waking for feeds
- not sucking effectively
- appearing unsettled
- demanding very frequent feeds
- Jitteriness (excessive unprovoked repetitive movements of ≥1 limb) is common and is not by itself an indication to measure blood glucose

## RISK FACTORS FOR HYPOGLYCAEMIA – all to be given RED blanket & 34-36+6/40 to also be given RED hat

- Born <37 weeks' gestation
- Fetal growth restriction
- birth ≤$2^{nd}$ centile (**Table 1**) or
- clinically wasted (e.g. >2 centiles discrepancy between occipital frontal circumference and weight using age and sex normalised charts)
- Babies of mothers with diabetes
- Babies of mother taking beta blockers in third trimester and/or at time of delivery

**Table 1: Second centile weights for boys and girls by week of gestation**

| Gestational age (weeks) | Weight (kg) | |
|---|---|---|
| | 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 |

**Flowchart 1: Management of babies at risk of hypoglycaemia (risk factors listed above)**

- Commence observations using **BAPM Newborn Early Warning Trigger and Track Framework (NEWTT2)**
- Dry and place baby in skin-to-skin care in a warm, draught free room
- Ensure baby kept warm
- Put hat on baby and cover with warm blanket (RED blanket for all plus RED hat for 34-36+6/40)
- Discuss with parents and provide written information that explains:
  - how to prevent hypoglycaemia
  - why baby needs blood glucose monitoring
  - signs that may indicate hypoglycaemia (see **Box 2**)
- Advise parents to inform member of healthcare team if concerned about baby's wellbeing

**≥37 weeks' gestation**

- **Ensure baby offered feed within first hour**:
  - encourage and support early breastfeeding within first hour after birth, then offer breast in response to feeding cues as often as possible
  - for mothers who choose to formula feed give 40–60 mL/kg/day within the first hour after birth

**<37 weeks' gestation**

- Ensure baby fed within first hour
- Baby requires a feeding plan in place
- May require NGT feeding to maintain adequate blood glucose levels
- Refer to **Early Postnatal Care of the Moderate-Late Preterm Infant – A Framework for Practice, British Association of Perinatal Medicine January 2023** for full care

**Check blood glucose before 2nd feed (2–4 hr after birth):**
**≥37 weeks' gestation: Is blood glucose level ≥2.0 mmol/L?**
**<37 weeks' gestation: Is blood glucose level ≥2.6 mmol/L?**

No → See **Flowchart 2 or Flowchart 3 depending on gestation**

Yes ↓

- Encourage frequent feeding and ensure <3 hr from the start of one feed to the start of the next feed
- Assess need for assisting mother with ongoing help with:
  - feeding
  - hand expression
  - recognition of early feeding cues
  - signs of effective attachment and feeding

No → See **Flowchart 2 or Flowchart 3 depending on gestation**

**≥37 weeks' gestation**

- If baby not showing signs of effective feeding:
  - encourage continuous skin-to-skin contact and encourage mother to hand express
  - continue to express 8–10 times in 24 hr until baby feeding effectively
  - if no colostrum available, discuss with mother and supplement with formula milk 40–60 mL/kg/day until colostrum available
- If formula-fed, give 40–60 mL/kg/day per feed 3-hrly over first 24 hr of life

**<37 weeks' gestation**

- Follow baby's feeding plan and care plan as per **Early Postnatal Care of the Moderate-Late Preterm Infant – A Framework for Practice, British Association of Perinatal Medicine January 2023**
- If uncoordinated and not feeding effectively, may require NGT feeds

**Check blood glucose level before 3rd feed**
**≥37 weeks' gestation: Is blood glucose level ≥2.0 mmol/L?**

- **Note**: NEWTT2 suggests repeating a set of observations in 1 hr if blood glucose 2.0–2.5 mmol/L excluding blood glucose unless otherwise indicated

**<37 weeks' gestation: Is blood glucose level ≥2.6 mmol/L?**

Yes ↓

- Continue to support responsive breastfeeding
- ensure mother understands how to assess effective feeding and escalate concerns

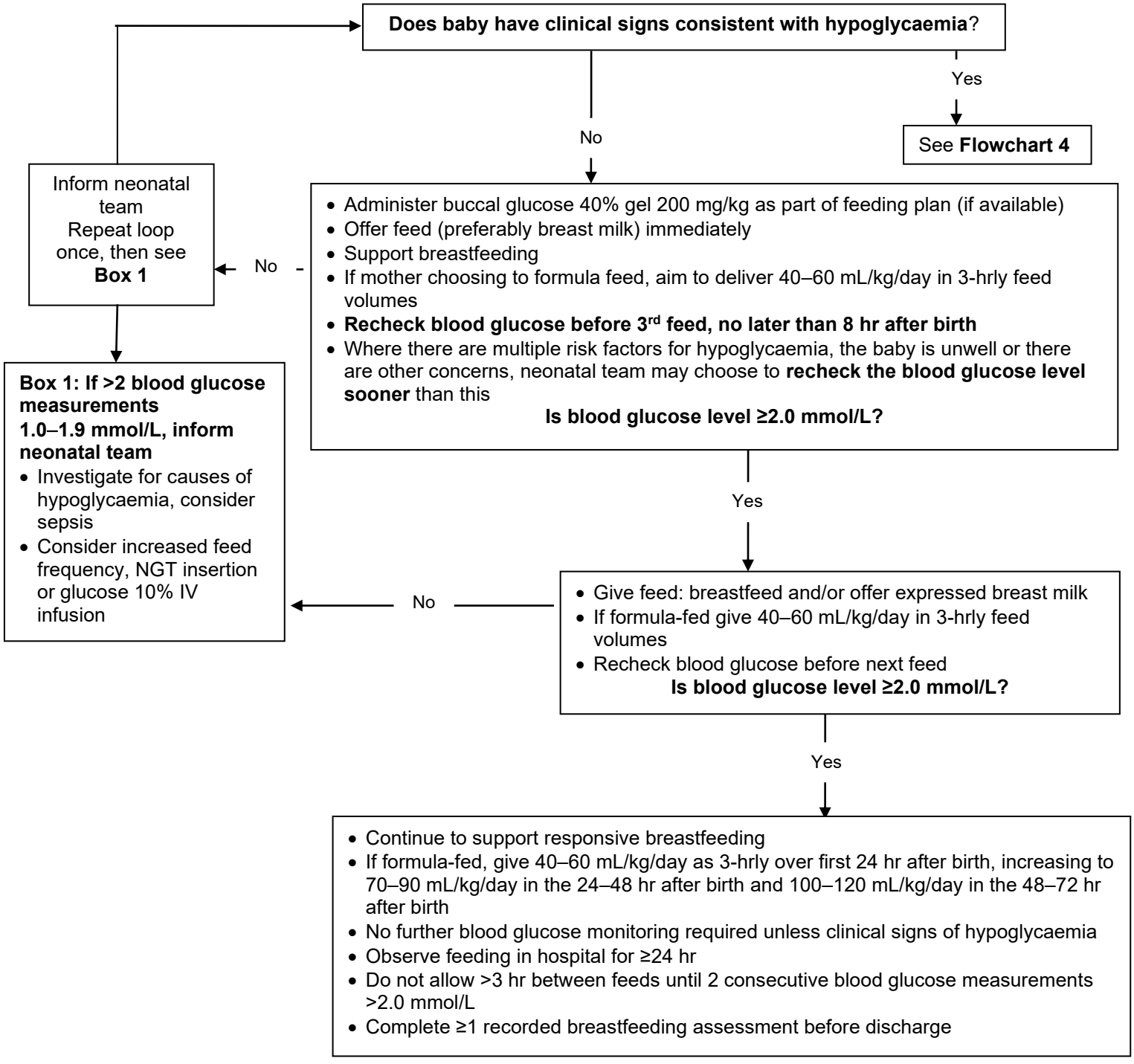
**≥37 weeks' gestation**

- If formula-fed, give 40–60 mL/kg/day 3-hrly over first 24 hr after birth, increasing to 70–90 mL/kg/day in 24–48 hr after birth, and 100–120 mL/kg/day in first 48–72 hr after birth
- No further blood glucose monitoring required unless clinical signs of hypoglycaemia
- Observe feeding in hospital for ≥24 hr
- Do not allow >3 hr between feeds until 2 consecutive blood glucose measurements >2.0 mmol/L
- Complete at ≥1 recorded breastfeeding assessment before discharge

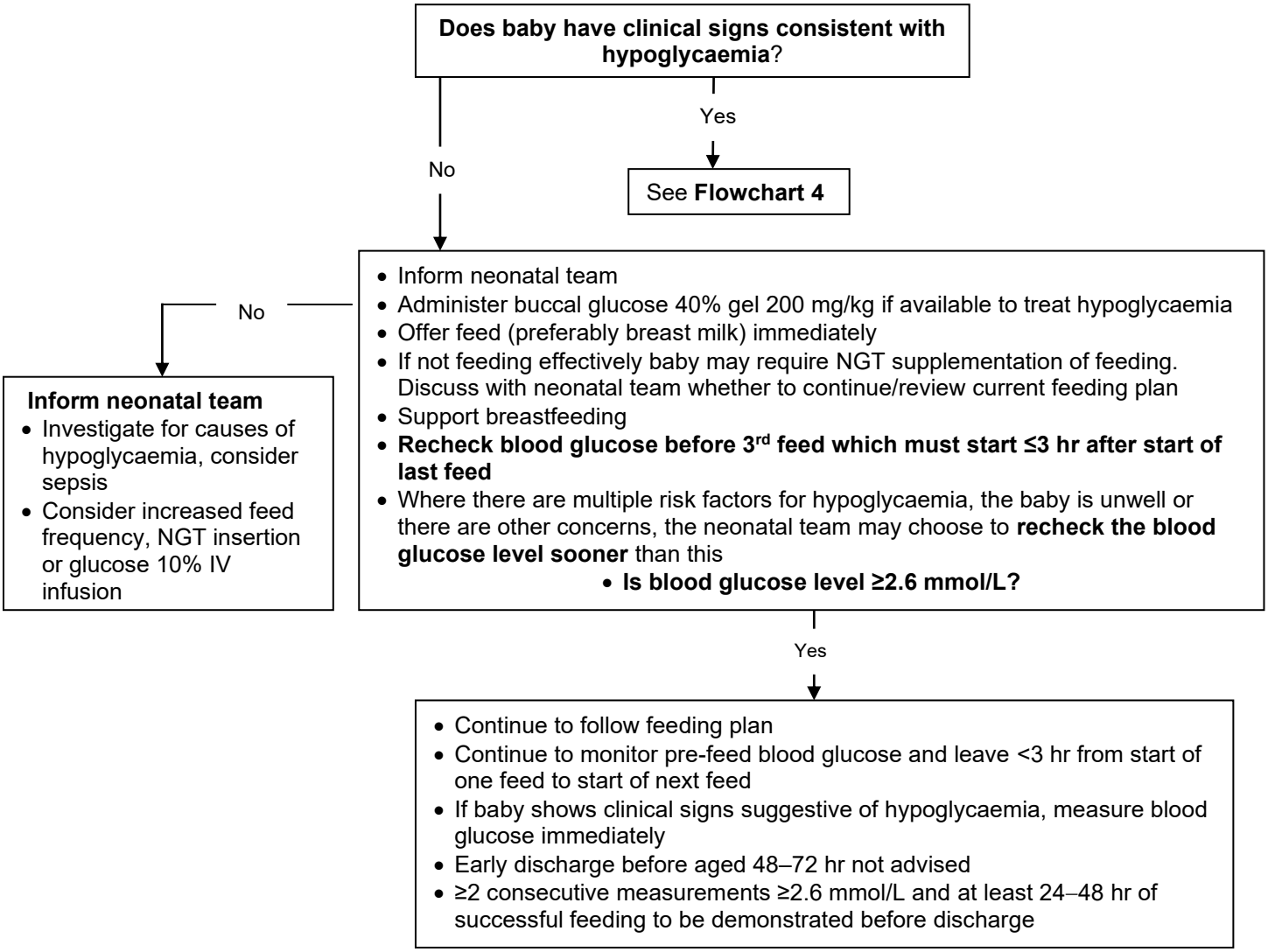
**<37 weeks' gestation**

- Continue to follow feeding plan
- If baby shows clinical signs suggestive of hypoglycaemia, measure blood glucose immediately
- Early discharge before 48–72 hr not advised.
- ≥2 consecutive measurements ≥2.6 mmol/L and at least 24–48 hr of successful feeding to be demonstrated before discharge

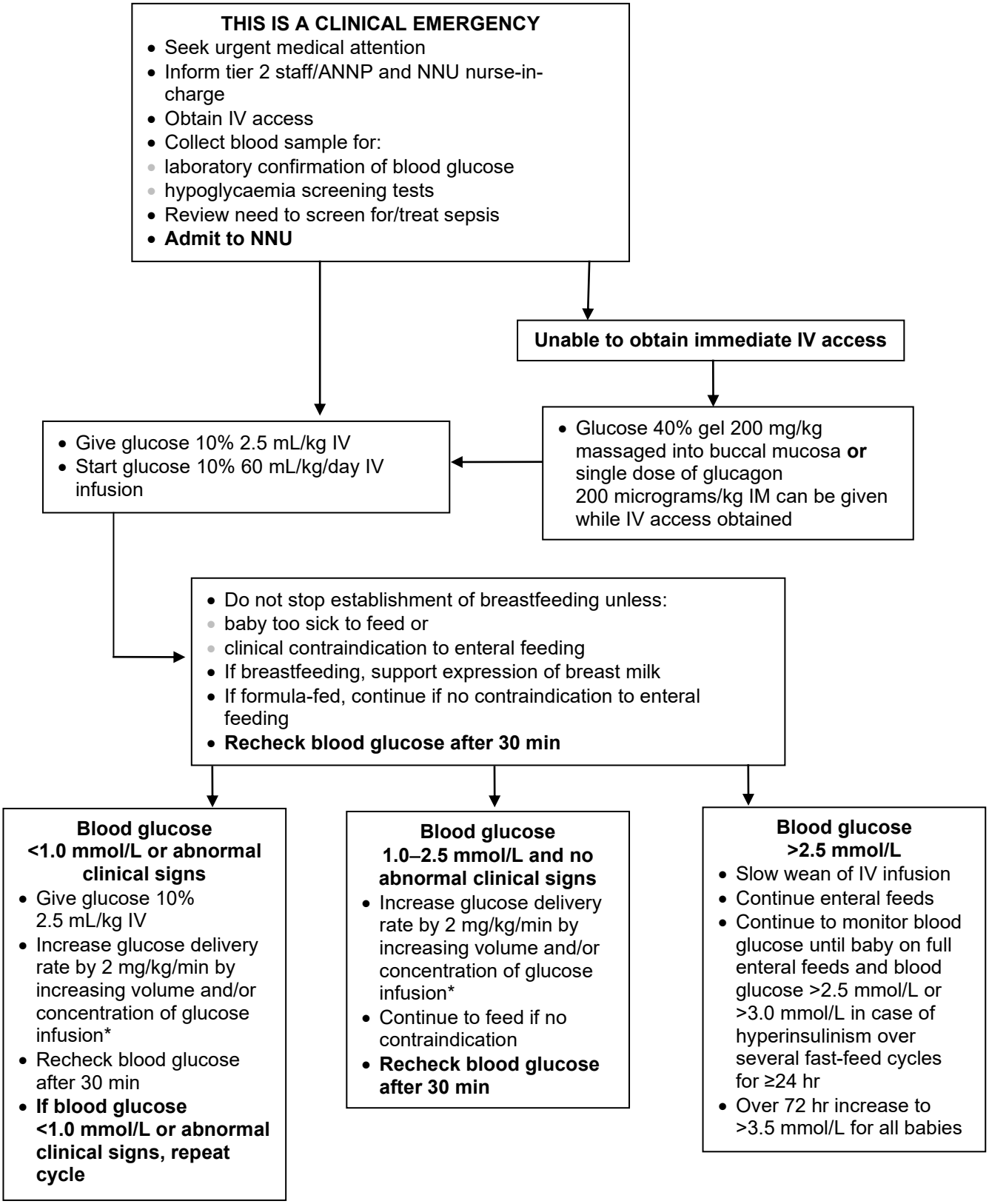
**Flowchart 2: ≥37 weeks' gestation with pre-feed blood glucose 1.0–1.9 mmol/L and no abnormal clinical signs**



**Flowchart 3: <37 weeks' gestation with pre-feed blood glucose 1.0–2.5 mmol/L and no abnormal clinical signs**



**Flowchart 4: Blood glucose <1.0 mmol/L at any gestation and/or clinical signs consistent with hypoglycaemia**




*** If glucose infusion rate >8 mg/kg/min (see calculation below), test for hyperinsulinism.**

# SIGNS THAT MAY INDICATE HYPOGLYCAEMIA

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

# SUPPORTING BREASTFEEDING

- Encourage continuous skin-to-skin contact
- Offer breastfeed and if not feeding effectively teach mother to hand express
- Give obtained colostrum to baby by method suitable to parents
- Continue to encourage hand expression ≥8–10 times in 24 hr and support breastfeeding until baby is feeding effectively

# BUCCAL GLUCOSE GEL

- Buccal glucose 40% gel 200 mg/kg (0.5 mL/kg of 40% gel) may be used as part of feeding plan in term babies
- use 2.5 or 5 mL oral/enteral syringe
- dry oral mucosa with gauze, gently squirt gel with syringe (no needle) onto inner cheek and massage gel into mucosa using latex-free gloves
- offer a feed (preferably breast milk) immediately
- repeat blood glucose measurement as requested
- if baby remains hypoglycaemic repeat buccal dextrose 40% gel (see **Flowchart 2**)
- if >2 blood glucose measurements 1.0–1.9 mmol/L inform neonatal team to examine and take action as **Box 1**,**Flowchart 2**
- maximum 6 doses in 48 hr
- Continue to support feeding
- Babies <37 weeks' gestation:
- glucose gel may be used to treat hypoglycaemia whilst obtaining IV access – see **Flowchart 4**
- glucose gel only be used as part of feeding plan if advised by neonatal team
- to ensure nutritional needs are met neonatal team may advise
  - increased feed frequency
  - NGT insertion
  - glucose 10% IV
  - see **Flowchart 3**

# MEASUREMENT OF BLOOD GLUCOSE

- Accurate measurement of blood glucose level essential for diagnosis and management of neonatal hypoglycaemia
- Ward-based blood gas biosensor (blood gas machine) is the reference standard for measuring blood glucose
- All current cotside devices are prone to inaccuracy, particularly in range 0–2.0 mmol/L
- If handheld glucometer used:
- confirm low values using an accurate method (blood gas analyser or laboratory sample)
- use only devices conforming to ISO 15197:2013 standard
- Blood samples with high PCV can produce erroneously low results

# INVESTIGATIONS FOR HYPOGLYCAEMIA

**Indications**

- Severe hypoglycaemia (<1.0 mmol/L) at any time
- Persistent hypoglycaemia (>2 measurements <2.0 mmol/L ≥37 weeks' gestation or <2.6 mmol/L <37 weeks' gestation within the first 48 hr of life).
- Signs of acute neurological dysfunction and blood glucose <2.5 mmol/L at any time

**Investigations**

- Review baby to assess if infection screen and treatment required (see **Infection in the first 72 hours of life** guideline)
- Perform following investigations **during** hypoglycaemia

| Blood | Urine |
|---|---|
| **Glucose*** | Ketones (dipstick) |
| **Lactate*** | Urine organic acids |
| **Insulin and C-Peptide*** | |
| **Cortisol*** | |
| Free fatty acids | |
| Ketone bodies | |
| Acylcarnitine profile | |
| Plasma amino acids | |
| Ammonia (venous) | |
| Growth hormone | |

***** If insufficient blood obtained during hypoglycaemia prioritise investigations in **bold** (ensure remainder obtained as soon as possible after correcting hypoglycaemia)

- Further investigations as necessary based on results of initial screen and following specialist advice
- for specialist metabolic advice, contact metabolic on-call consultant via Birmingham Children's Hospital switchboard 0121 333 9999
- In a clinically well baby, provided no known risk factors, no abnormal clinical signs and baby feeding well, a one-off episode of transient hypoglycaemia, defined as 1 measurement between 1.0–1.9 mmol/L within the first 48 hr of life, does not require investigation

# PERSISTENTLY LOW BLOOD GLUCOSE MEASUREMENT

- Defined as >2 measurements <2.0 mmol/L ≥37 weeks' gestation **or** <2.6 mmol/L <37 weeks' gestation within the first 48 hr of life
- May be the first sign of hyperinsulinism or another metabolic disorder characterised by hypoglycaemia
- If blood glucose concentration remains low (<2.0 mmol/L ≥37 weeks' gestation **or** <2.6 mmol/L <37 weeks' gestation) on ≥3 occasions in the first 48 hr, despite adequate energy provision and a feeding plan, or a glucose dose >8 mg/kg/min (glucose 10% 115 mL/kg/day infusion) is required, suspect hyperinsulinism
- Babies with suspected or confirmed hyperinsulinism may require non-standard glucose infusions to achieve target blood glucose concentration. See below for advice on making up such an infusion
- If hyperinsulism suspected or confirmed, aim to maintain blood glucose >3.0 mmol/L until insulin levels are known
- Hyperinsulinism confirmed if paired insulin and glucose measurements taken whilst hypoglycaemic give glucose:insulin ratio <0.3, or if insulin >10 picomole/L when glucose <2.0 mmol/L
- If baby suspected of having hyperinsulinism discuss with the national centre for hyperinsulinism at Royal Manchester Children's Hospital
- Give glucose ≥12.5% infusion via a central line [see **Umbilical venous catheter insertion and removal** and **Long line insertion (peripherally sited)** guidelines]

**Glucose calculations**

***Calculation of glucose infusion rate***

- Glucose infusion rate in mg/kg/min = % glucose × fluid volume in mL/kg/day / 144

**IV glucose concentration**

| Flow rate of glucose 10% (mL/kg/day) | Infusion rate (mg/kg/min) |
|---|---|
| 40 | 2.77 |
| 60 | 4.16 |
| 80 | 5.55 |
| 100 | 6.94 |
| 120 | 8.33 |
| 130 | 9.03 |
| 140 | 9.72 |
| 150 | 10.42 |

***To make up any concentration of glucose in any volume***

- Desired volume = V mL
- Desired concentration of glucose = D%
- Lower concentration of glucose = L%
- Volume of lower concentration of glucose to add = LV mL
- Higher concentration of glucose = H%
- Volume of higher concentration of glucose to add = HV mL

Formula: $HV = V (D-L) / (H-L)$
$LV = V-HV$

$HV\ mL + LV\ mL = V\ mL\ of\ D\%$

- If ≥12.5% glucose required, give via a central line [see **Umbilical venous catheter insertion and removal** and **Long line insertion (peripherally sited)** guidelines]