

HYPOGLYCAEMIA • 1/8

BABIES <37 WEEKS' GESTATION

Management of these babies should follow the guidance below with the following amendments

- Use blood glucose threshold of >2.6 mmol/L (instead of 2.0 mmol/L)
- Continue to monitor blood sugar pre-feed until 4 consecutive values >2.6 mmol/L
- Screen ALL infants <36 weeks for hypoglycaemia
- Use nasogastric (NG) feeds (see **Nasogastric tube administration of feed, fluid or medication** guideline) in preference to IV fluids for a well baby who is unable to take sufficient milk volumes orally
- If baby 34–36⁺ weeks unable to tolerate NG feeds, admit to NNU for IV fluids

BABIES ≥37 WEEKS' GESTATION

- Follow the guidance below which is based on Identification and Management of Neonatal Hypoglycaemia in the Full Term Infant – A Framework for Practice, British Association of Perinatal Medicine April 2017

RISK FACTORS FOR HYPOGLYCAEMIA

- Intrauterine growth restriction
- birth ≤2nd centile (**Table 1**) or
- clinically wasted
- Babies of diabetic mother
- Babies of mother taking beta blockers in third trimester and/or at time of delivery

Table 1: 2nd centile weight

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

CLINICAL SIGNS SUGGESTIVE OF HYPOGLYCAEMIA

- Presence of ≥1 of the following clinical signs/diagnoses is an indication to measure blood glucose:
- perinatal acidosis (cord arterial or baby pH <7.1 and base deficit ≥-12)
- hypothermia (≤36.5°C) not attributable to environmental factors
- suspected/confirmed early neonatal sepsis
- cyanosis
- apnoea
- altered level of consciousness
- seizures
- hypotonia
- lethargy
- high pitched cry
- abnormal feeding behaviour (not waking for feeds, not sucking effectively, appearing unsettled, demanding very frequent feeds) **especially after a period of feeding well** may be indicative of hypoglycaemia
- jitteriness (excessive repetitive movements of ≥1 limb which are unprovoked and not in response to stimulus) is common and is not by itself an indication to measure blood glucose

MEASUREMENT OF BLOOD GLUCOSE

- Accurate measurement of blood glucose level is essential for diagnosis and management of neonatal hypoglycaemia
- A ward-based blood gas biosensor (blood gas machine) should be considered the reference standard for measuring blood glucose
- All current cot-side devices are prone to inaccuracy, particularly in the range 0–2.0 mmol/L

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- 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

INITIAL MANAGEMENT OF BABY AT RISK OF HYPOGLYCAEMIA

- Provide parents with written information, e.g. www.bapm.org/publications/Hypoglycaemia%20F4P%20May%202017.pdf
- Ensure baby is kept warm and commence skin-to-skin contact
- Begin care pathway in **Flowchart 1**
- Ensure baby offered feed within first hour
- Offer breast in response to feeding cues as often as possible
- Do not allow >3 hr between feeds until 2 consecutive blood glucose measurements >2.0 mmol/L
- 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 10–15 mL/kg until colostrum available
- If mother chooses to formula feed:
 - offer 10–15 mL/kg within the first hour and plan to feed 3-hrly
 - when 2 consecutive blood glucose measurements >2.0 mmol/L, demand feed
- Measure blood glucose level before second feed (2–4 hr after birth), or sooner if clinical signs suggestive of hypoglycaemia

SUBSEQUENT MANAGEMENT

Based on first blood glucose result, place baby on 1 of the following care pathways:

First pre-feed blood glucose ≥ 2.0 mmol/L

- Continue to follow **Flowchart 1**
- Check blood glucose before third feed (≤ 8 hr after birth)
- if ≥ 2.0 mmol/L no further blood glucose measurement required. Observe feeding for 24 hr and complete ≥ 1 breastfeeding assessment before discharge (see **Breastfeeding** guideline)
- if <2.0 mmol/L follow **Flowchart 2**

First pre-feed blood glucose 1.0–1.9 mmol/L and no abnormal signs

- Follow **Flowchart 2**
- Buccal dextrose 40% gel 200 mg/kg (0.5 mL/kg of 40% gel) may be used as part of feeding plan
- 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 oral dextrose gel (see **Flowchart 2**)
- maximum 6 doses in 48 hr
 - discuss with neonatal team before giving second dose
 - examine baby before third dose
- Continue to support feeding as above
- After 2 consecutive values >2.0 mmol/L discontinue blood glucose measurement. Observe feeding for 24 hr and complete ≥ 1 breastfeeding assessment before discharge (see **Breastfeeding** guideline)
- If baby displays clinical signs consistent with hypoglycaemia, or >2 measurements 1.0–1.9 mmol/L, follow **Flowchart 3**

First pre-feed blood glucose <1.0 mmol/L, and/or clinical signs consistent with hypoglycaemia

- Follow **Flowchart 3**
- Seek urgent medical attention and admit to NNU
- Obtain IV access
- Collect blood samples for confirmation of blood glucose and hypoglycaemia screening tests (see **Investigations**)
- Review need to screen for/treat sepsis (see **Infection in the first 72 hours of life** guideline)
- Give glucose 10% 2.5 mL/kg IV and start infusion of glucose 10% at 60 mL/kg/day

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- If unable to obtain immediate IV access, as an interim measure whilst awaiting IV access, give either:
- dextrose 40% gel 200 mg/kg (equivalent to 0.5 mL/kg of 40% gel) as detailed above **or**
- single dose of glucagon 200 microgram/kg IM
- Recheck blood glucose after 30 min and continue to follow **Flowchart 3**

INVESTIGATIONS FOR HYPOGLYCAEMIA

Indications

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

Investigations

Perform following investigations **during** the period of hypoglycaemia

- Blood
 - glucose
 - insulin
 - cortisol
 - growth hormone
 - fatty acids
 - ketone bodies
 - carnitine
 - acylcarnitine profile
 - amino acids
 - ammonia
 - lactate
- Urine
 - ketones
 - organic acids
- Review need to screen for/treat sepsis (see **Infection in the first 72 hours of life** guideline)
- Further investigations based on results of initial screen and following specialist advice
- Transient hypoglycaemia, defined as 1 measurement 1.0–1.9 mmol/L within the first 48 hr of life, in baby with no abnormal signs who is feeding effectively, does not require investigation

PERSISTENTLY LOW BLOOD GLUCOSE MEASUREMENT

- Defined as >2 measurements <2.0 mmol/L 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) 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
- If hyperinsulinism suspected or confirmed, aim to maintain blood glucose >3.0 mmol/L
- 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** guidelines)

Calculation of glucose infusion rate

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

Intravenous 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

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150	10.42
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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

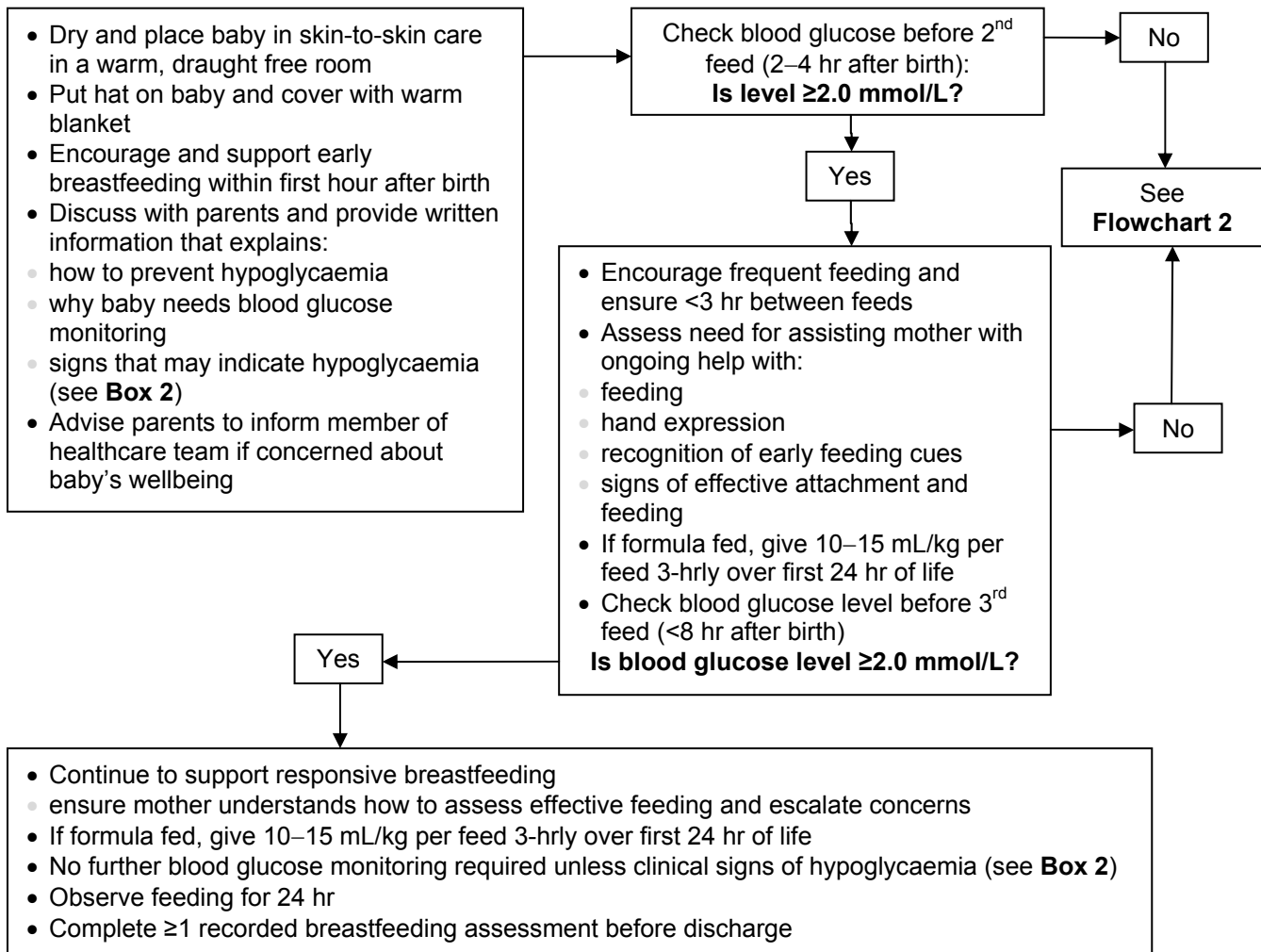
Formula: $HV = V (D-L) / (H-L)$
 $LV = V - HV$

$HV \text{ mL} + LV \text{ mL} = V \text{ mL of D\%}$

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

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Flowchart 1: Management of babies ≥ 37 weeks at risk of hypoglycaemia



Box 1: Babies requiring routine blood glucose monitoring

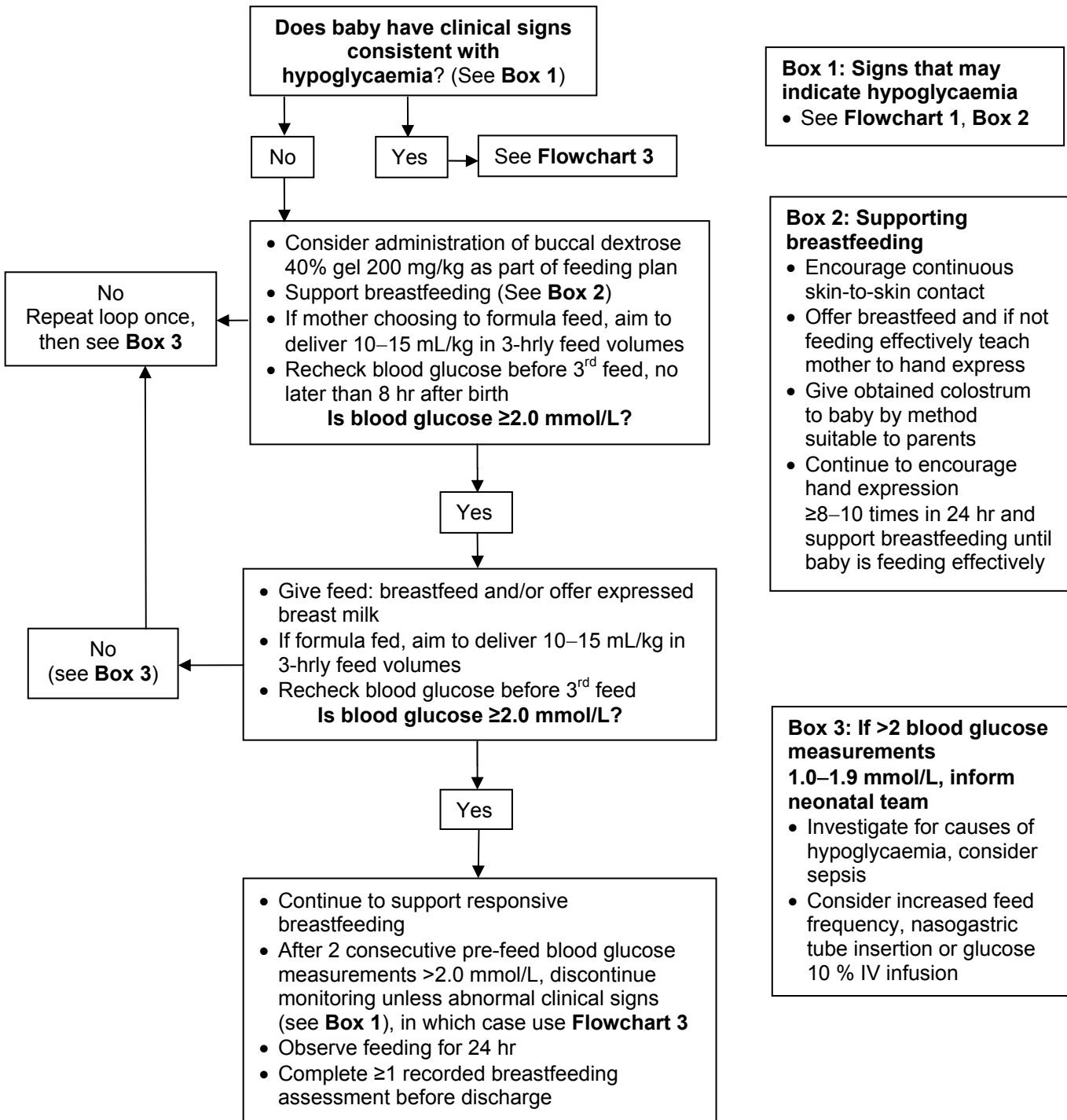
- Intrauterine growth restriction ($\leq 2^{\text{nd}}$ centile for gestation, age and sex, refer to BAPM NEWTT thresholds – see **Table 1**) or clinically wasted
- Babies of diabetic mothers
- Maternal beta blocker use

Box 2: 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 ($\leq 36.5^{\circ}\text{C}$)
- Cyanosis
- Apnoea

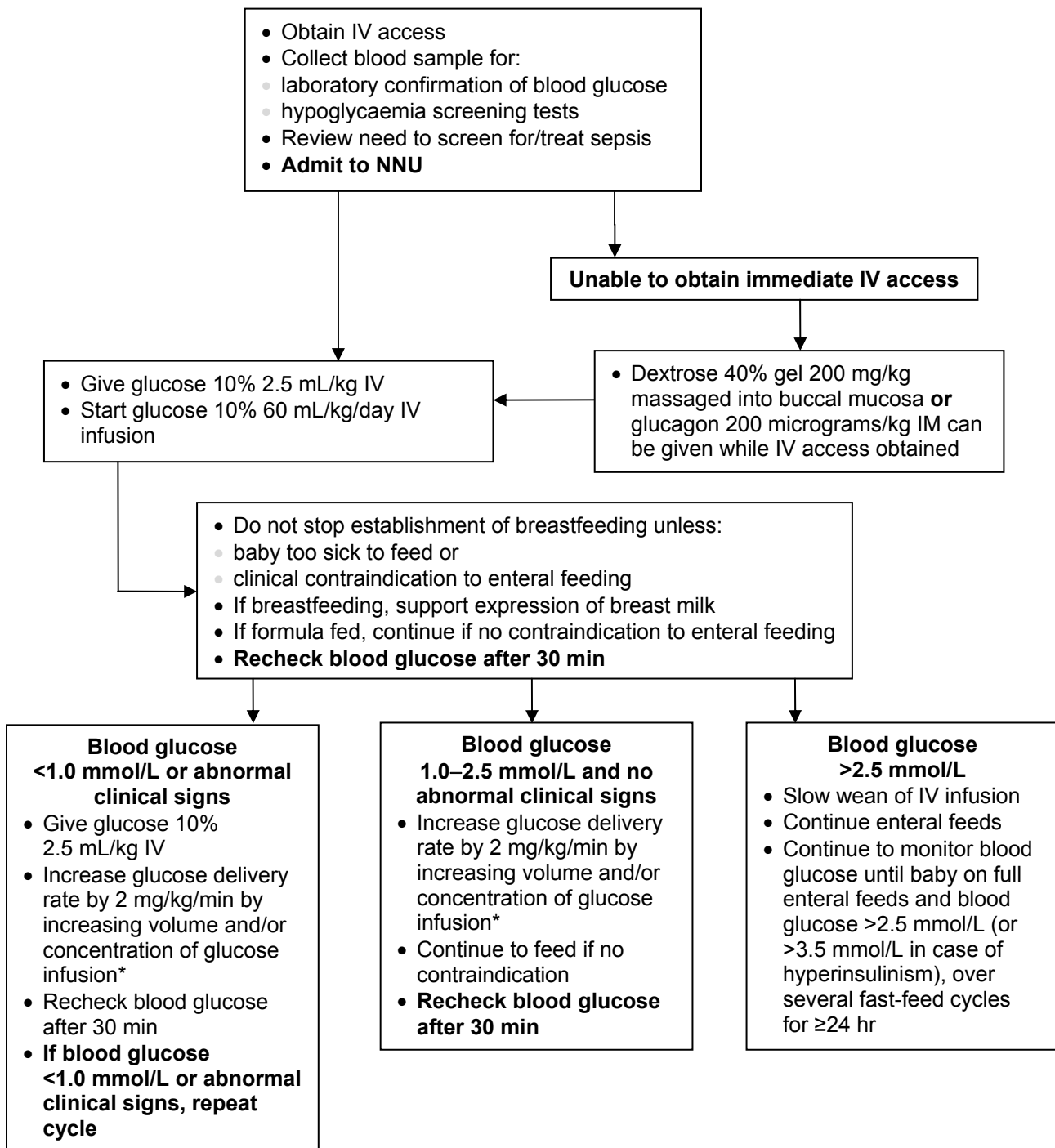
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Flowchart 2: Pre-feed blood glucose 1.0–1.9 mmol/L and no abnormal clinical signs



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Flowchart 3: Blood glucose <1.0 mmol/L and/or clinical signs consistent with hypoglycaemia



* If glucose infusion rate >8 mg/kg/min, test for hyperinsulinism

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Flowchart 4: Management of reluctant feeding in healthy breastfed infants ≥37 weeks

