HYPOGLYCAEMIA ● 1/8

BABIES <37 WEEKS' GESTATION

Management of these babies should follow the guidance below with the following amendments (See Flowchart 4&5)

- 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** babies <37 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^{+6} 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 – TO BE GIVEN RED BLANKET

- Intrauterine growth restriction
- birth ≤2^{nd} 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: Second centile weights for boys and girls by week of gestation (see https://www.bapm.org/resources/newborn-early-warning-trigger-track-newtt-framework-practice)

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
- 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. https://hubble-live-assets.s3.amazonaws.com/bapm/attachment/file/53/Identification_and_Management_of_Neonatal_Hypoglycaemia_in_the__full_term_infant_-_A_Framework_for_Practice_revised_Oct_2017.pdf
- Provide red blanket
- Ensure baby 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 in hospital and complete at least one 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 buccal dextrose 40% 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
- If unable to obtain immediate IV access, as an interim measure whilst awaiting IV access, give either:
  - buccal 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
- 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]

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

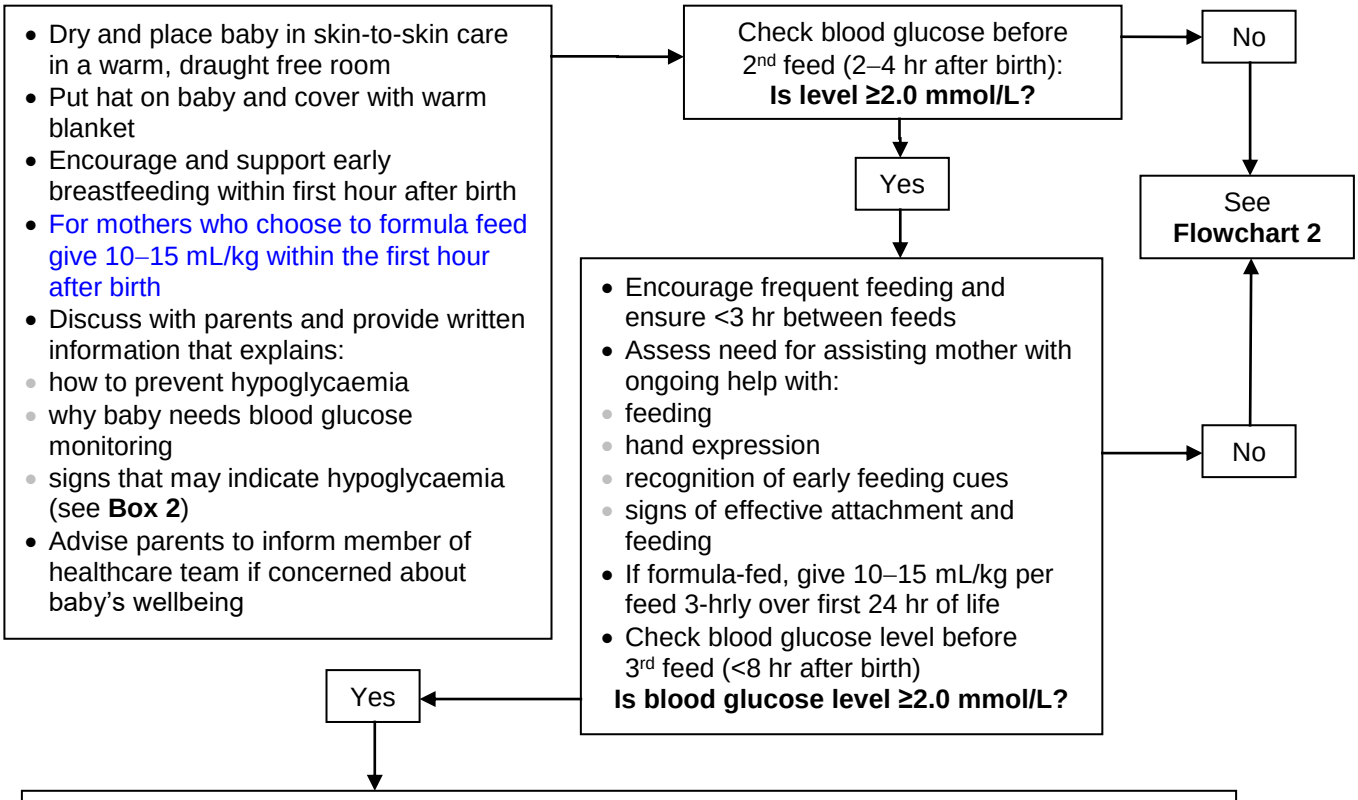
- Desired volume = V mL
- Desired concentration of glucose = D%
- Lower concentration of glucose = L%
- Volume of lower concentration of glucose to add = LV mL
- Higher concentration of glucose = H%
- Volume of higher concentration of glucose to add = HV mL

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]

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



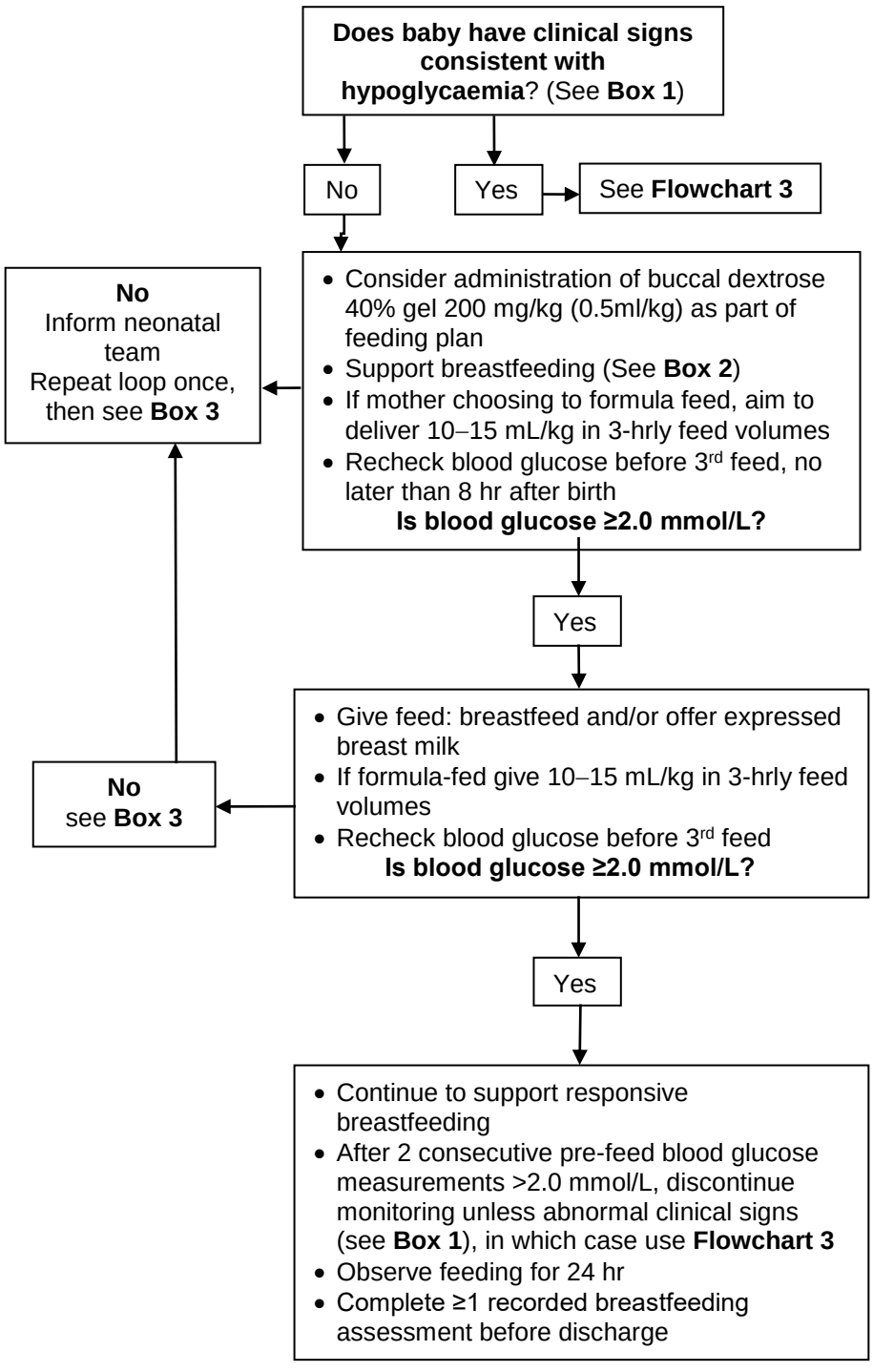
Box 1: Babies requiring routine blood glucose monitoring

- Intrauterine growth restriction (≤2nd 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 (<36.5°C)
- Cyanosis
- Apnoea

Flowchart 2: Pre-feed blood glucose 1.0–1.9 mmol/L and no abnormal clinical signs in ≥37 weeks



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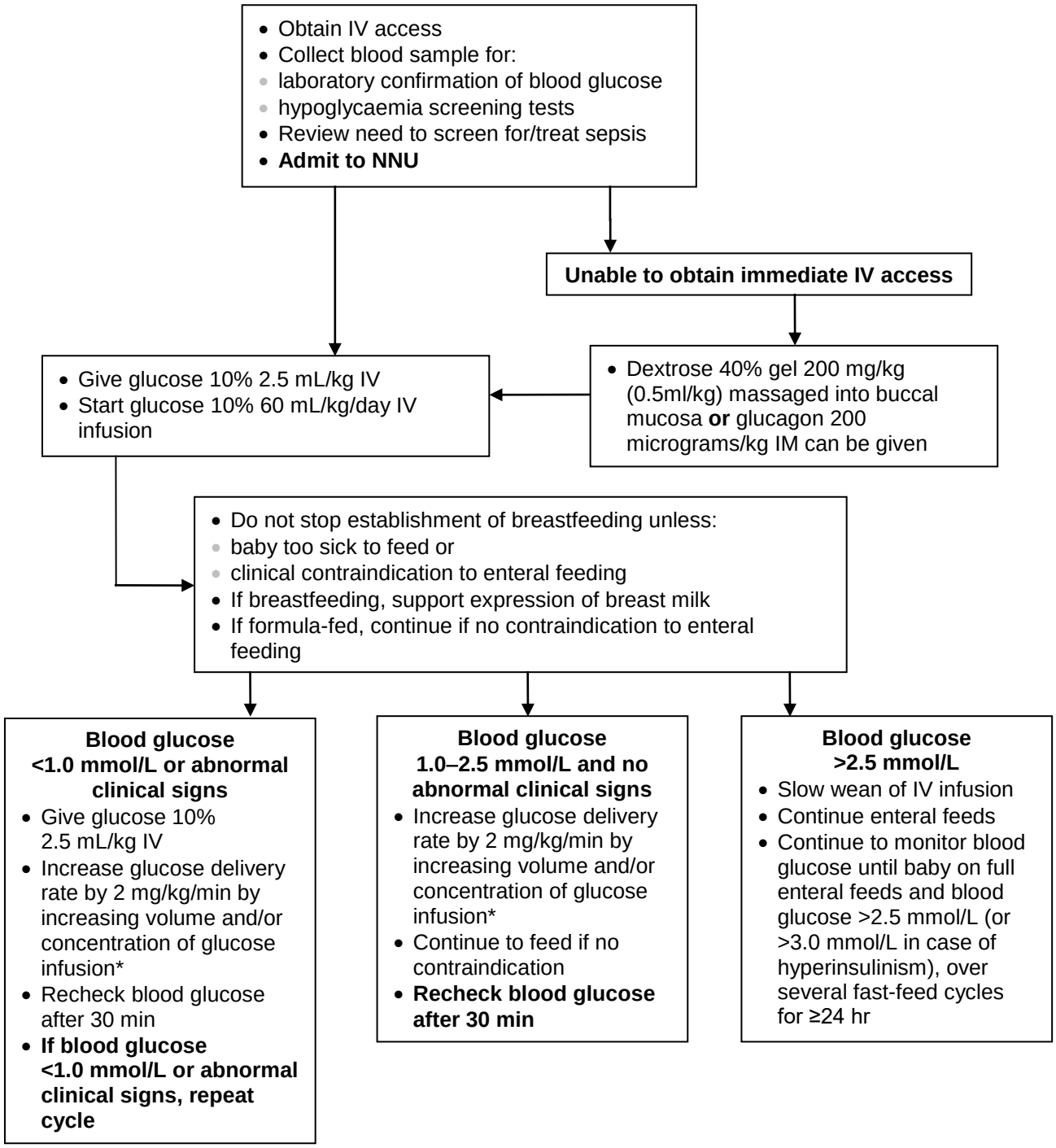
Box 2: Supporting breastfeeding

- 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

Box 3: If >2 blood glucose measurements 1.0–1.9 mmol/L, inform neonatal team

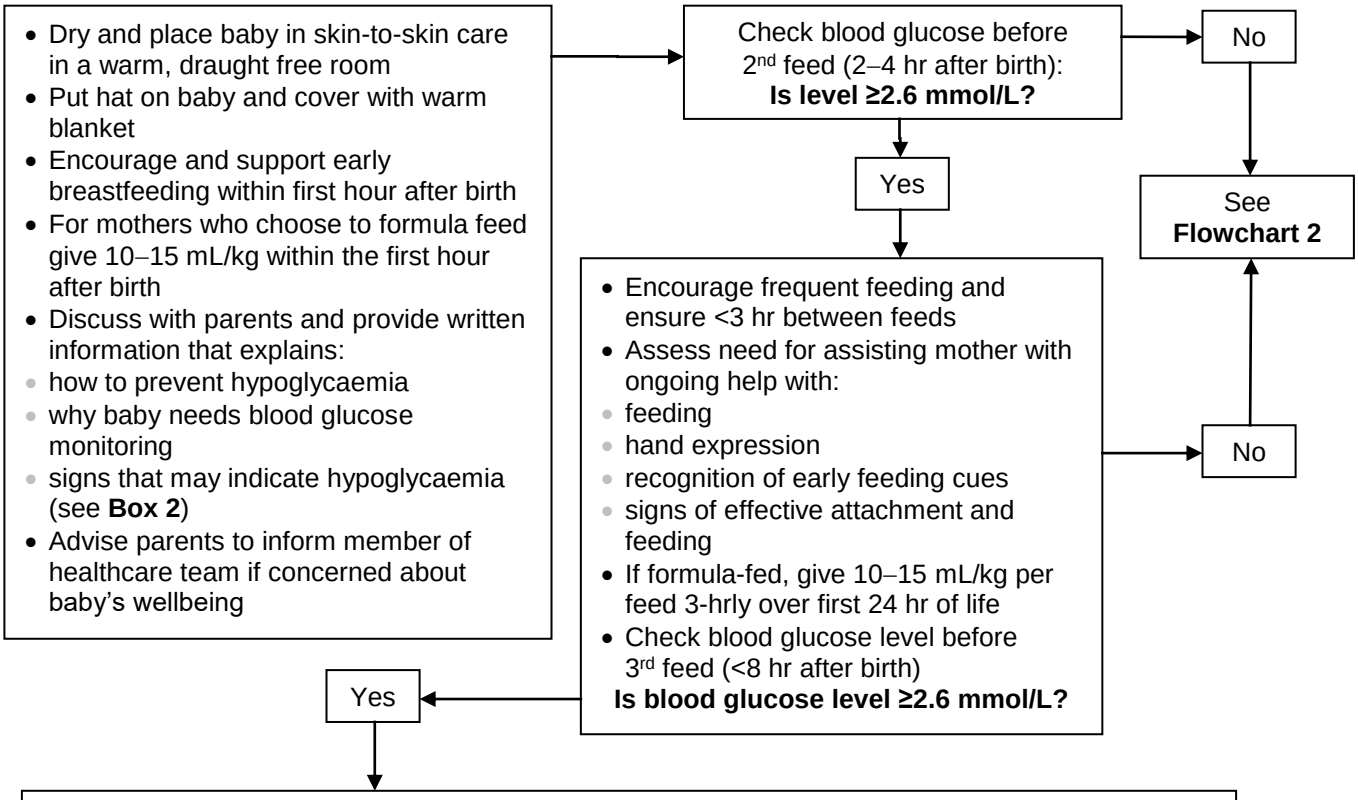
- Investigate for causes of hypoglycaemia, consider sepsis
- Consider increased feed frequency, NGT insertion or glucose 10% IV infusion

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



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

Flowchart 4: Management of babies <37 weeks at risk of hypoglycaemia



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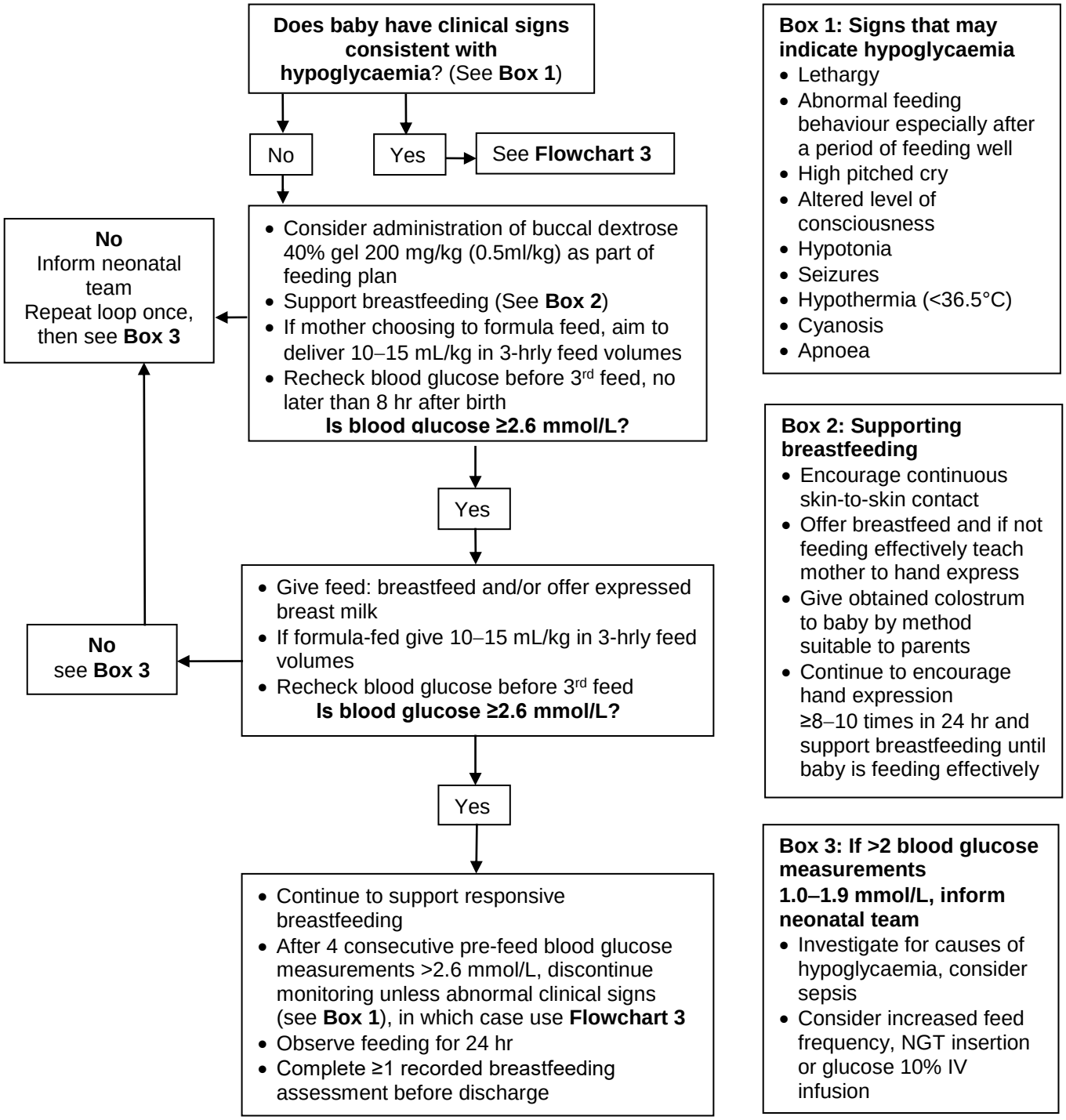
Flowchart 5: Pre-feed blood glucose 1.0–1.9 mmol/L and no abnormal clinical signs <37 weeks



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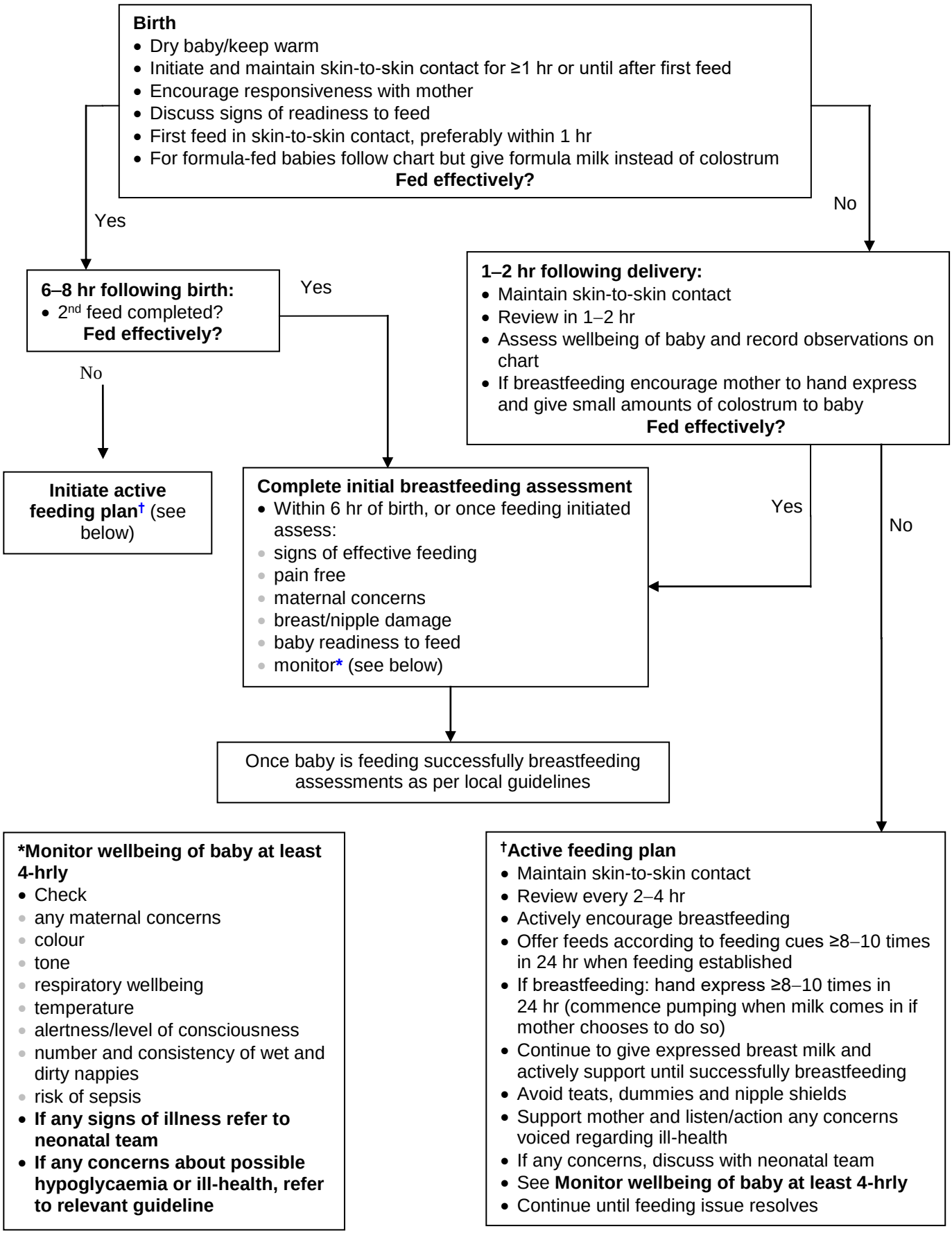
Box 3: If >2 blood glucose measurements 1.0–1.9 mmol/L, inform neonatal team

- Investigate for causes of hypoglycaemia, consider sepsis
- Consider increased feed frequency, NGT insertion or glucose 10% IV infusion

Flowchart 6: Management of reluctant feeding in healthy breastfed infants



***Monitor wellbeing of baby at least 4-hrly**

- Check
  - any maternal concerns
  - colour
  - tone
  - respiratory wellbeing
  - temperature
  - alertness/level of consciousness
  - number and consistency of wet and dirty nappies
  - risk of sepsis
- **If any signs of illness refer to neonatal team**
- **If any concerns about possible hypoglycaemia or ill-health, refer to relevant guideline**

†Active feeding plan

- Maintain skin-to-skin contact
- Review every 2–4 hr
- Actively encourage breastfeeding
- Offer feeds according to feeding cues ≥8–10 times in 24 hr when feeding established
- If breastfeeding: hand express ≥8–10 times in 24 hr (commence pumping when milk comes in if mother chooses to do so)
- Continue to give expressed breast milk and actively support until successfully breastfeeding
- Avoid teats, dummies and nipple shields
- Support mother and listen/action any concerns voiced regarding ill-health
- If any concerns, discuss with neonatal team
- See **Monitor wellbeing of baby at least 4-hrly**
- Continue until feeding issue resolves