

Prevention and Management of Hypoglycaemia

Use for ALL babies on the Labour Ward, Postnatal Ward & Transitional Care.

[This guideline is based on the BAPM Hypoglycaemia Guideline 2017.](#)

This guideline should be used in concordance with the Bobble Hat Protocol and the aims of the Joey Project.

General Principles

HIGH RISK INFANTS

High risk babies should be identified by their midwife on Delivery Suite and the “Hypoglycaemia Pathway” using Flowchart A should be commenced and placed in the baby’s notes.

Parents should be given the leaflet “[Blood Sugars in Newborn Babies](#)”

High risk criteria include any one or more of:

- Prematurity (<37 weeks gestation – including all babies up to and including 36+6 weeks)
- Maternal beta blockers
- IUGR $\leq 2^{\text{nd}}$ centile on BAPM NEWTT centile chart or clinically wasted
- Infants of diabetic mothers (all types of diabetes)

Other factors may increase the risk of neonatal hypoglycaemia:

- Infection
- Polycythaemia
- Hypoxic-ischaemic encephalopathy
- Inborn errors of metabolism
- Pituitary/adrenal insufficiency
- Hyper-insulinism

Anticipate hypoglycaemia in these high risk infants, and involve parents EARLY (pre delivery if possible)

1. Use/encourage pre-delivery breast milk harvesting wherever possible
2. Ensure hypoglycaemia plan is in place prior to delivery and parents are aware of it.
3. Give parents the leaflet “Blood Sugars in Newborn Babies” (see guidelines)

Do NOT do a Blood Glucose (BG) before baby is 2 hours old <u>unless</u> there are clinical signs
BG >2.0mmol/L in an asymptomatic baby is normal.
BG 1.0-2.0mmol/L in an asymptomatic baby may represent transition – follow Flowchart B
BG <1.0mmol/L should be treated as an emergency as per Flowchart C
BG <2.5mmol/L accompanied by abnormal clinical signs requires treatment as per Flowchart C

- 1.) Rub dextrose gel into the inner cheek in correct amounts, promptly, according to blood sugars - 0.4ml/kg for all babies – As per Protocol
- 2.) Keep babies warm at all times - use of hot cots should be considered early.
- 3.) Avoid separation of mothers and infants.
- 4.) Severe blood glucose $<1.0\text{mmol/L}$ or persistent hypoglycaemia (3 or more measurements $<2.0\text{mmol/L}$) require medical review
- 5.) The role of the neonatal SHO/Registrar is to take a history, look for risk factors, examine the baby for signs/symptoms of hypoglycaemia, review the charts, support the parent(s) and midwife, and ensure baby is managed according to the guideline.
- 6.) By supporting the first few breastfeeds with dextrose gel whilst there is hypoglycaemia, the majority of babies will avoid formula use. The aim is for babies to be exclusively breastfed from birth if safe and possible.

LOW RISK INFANTS

Normally grown term infants who are well, warm and feeding properly are at low risk of hypoglycaemia and do not require routine BG testing. Infrequent feeding in a well infant is not an indication for BG testing – it is usual for a baby to feed as little as 4 times in the first 24 hours of life - but a baby should not go for longer than 8 hours between feeds.

If there are clinical concerns – if baby becomes systemically unwell or there are signs of hypoglycaemia, manage baby according to Flowchart A.

Background:

Blood glucose levels in the Newborn

As part of the normal postnatal adaptation, newborn infants' blood glucose levels fall immediately following delivery, reaching the lowest levels within 1-2 hours after birth. After that, in healthy, normally grown term babies the levels then spontaneously recover as feeds are established. The neonatal brain uses lactate as an alternative metabolic fuel whilst feeding is being established in the first 24 - 48 hours. However recent evidence indicates that there is also a hypoketotic state and so babies remain vulnerable until their blood sugar level normalises. Normal feeding is sufficient to support these babies through this transition

There are some groups of newborns who are at greater risk of symptomatic hypoglycaemia and risk of neuronal damage. For example, **preterm infants** and **IUGR/SGA infants** may have reduced glycogen stores, impaired gluconeogenesis due to liver immaturity and additional suppression of ketones production (as an alternative substrate).

Clinical Symptoms and Signs of Hypoglycaemia

Neurogenic (sympathetic nervous activity): jitteriness, tachycardia, pallor, hypothermia

Neuroglycopenic (impaired brain function): floppiness, sleepiness (more than 8 hours between feeds), irritability, poor feeding, cyanosis, tachypnoea, 'grunting', apnoeic episodes, weak or high-pitched cry, seizures.

Measurement of Blood Glucose (BG)

Do not check a BG in a baby less than 2 hours old – unless there are clear clinical signs suggesting hypoglycaemia.

The quickest / most convenient way to measure BG is with a handheld blood glucose meter. These consistently underestimate the actual sugar level compared to capillary blood gas glucose (CBG). Thus a low/borderline reading on portable glucose meter should be checked with a CBG, although treatment (e.g. with dextrose gel) should **not** be delayed. So if it is low, give dextrose gel promptly.

Jitteriness

Jitteriness is a poorly defined symptom and is **not** a definitive sign of hypoglycaemia (UNICEF). Many babies will appear jittery on handling, therefore a definition such as the following is suggested: "Excessive repetitive movements of one or more limbs, which are unprovoked and usually relatively fast. It is important to be sure that this movement is not simply a response to stimuli."

Measures for prevention and management of hypoglycaemia

General measures to PREVENT hypoglycaemia apply to all babies:

Keep babies warm and dry

Offer feeds early (high risk babies within 60 minutes of birth, low risk within 3 hours)

Preventing and Managing Hypoglycaemia in Newborns

Most babies at risk of / with hypoglycaemia will be managed by midwives on Delivery Suite/ Postnatal Ward without the need for escalation of medical intervention beyond dextrose gel administration. This approach supports breastfeeding and bonding, reduces the number of heel-pricks for the baby and shortens the length of stay.

Use and document on Flowchart A.

Use the **SBAR** (Situation-Background-Assessment-Recommendation) framework to ensure clear communication.

Dextrose Gel & Top Up Feeds

Dextrose gel is the immediate first-line treatment for any low blood sugar in a newborn baby. 0.4mls per kg of 40% dextrose gel should be given to the infant (200mg/kg glucose).

The infant should be fed (breast or formula according to maternal preference.) Every step should be taken to aid and support mothers who wish to breast feed to help with establishment of breast feeding.

There is no need to take post-feed BGs.

Provided that the BG is stable/improving and that the infant remains well and asymptomatic, treatments with dextrose gel can be used up to three times whilst ensuring warmth and 3 hourly feeding.

Pre-delivery harvested breast milk is very useful in the first day to support intake and blood sugars in preference to formula.

After 3 'rounds' of dextrose gel, if the blood sugar is still between 1.0mmol/L to 2.0mmol/L and the baby remains asymptomatic, then offer top-up milk supplements (EBM if available, formula if not) at 10mls/kg per feed (this equates to approximately 60mls/kg/day).

See Infant Feeding Team Reluctant Feeder Guideline.

If this is the baby's first low glucose reading (i.e. it was normal after the first feed but on retesting prior to the 3rd feed is now low) use dextrose gel and follow Flowchart A.

Persistent Moderate Hypoglycaemia

- BG are 1.0 - 2.0 mmol/L
- Infants remain asymptomatic and well

Postnatal Ward

Feeding more frequently may be adequate as the next step after 3 rounds of dextrose gel.

Following this, the commencement of “day ahead” volumes of EBM/formula supplements may sometimes be required at 90mls/kg/day on first day, 120mls/kg/day on second day, 150mls/kg/day on third day onwards.

Transitional Care

If an infant requires two hourly feeding, a nasogastric tube can be passed and the baby admitted to Transitional Care so that mothers and babies can be kept together where possible.

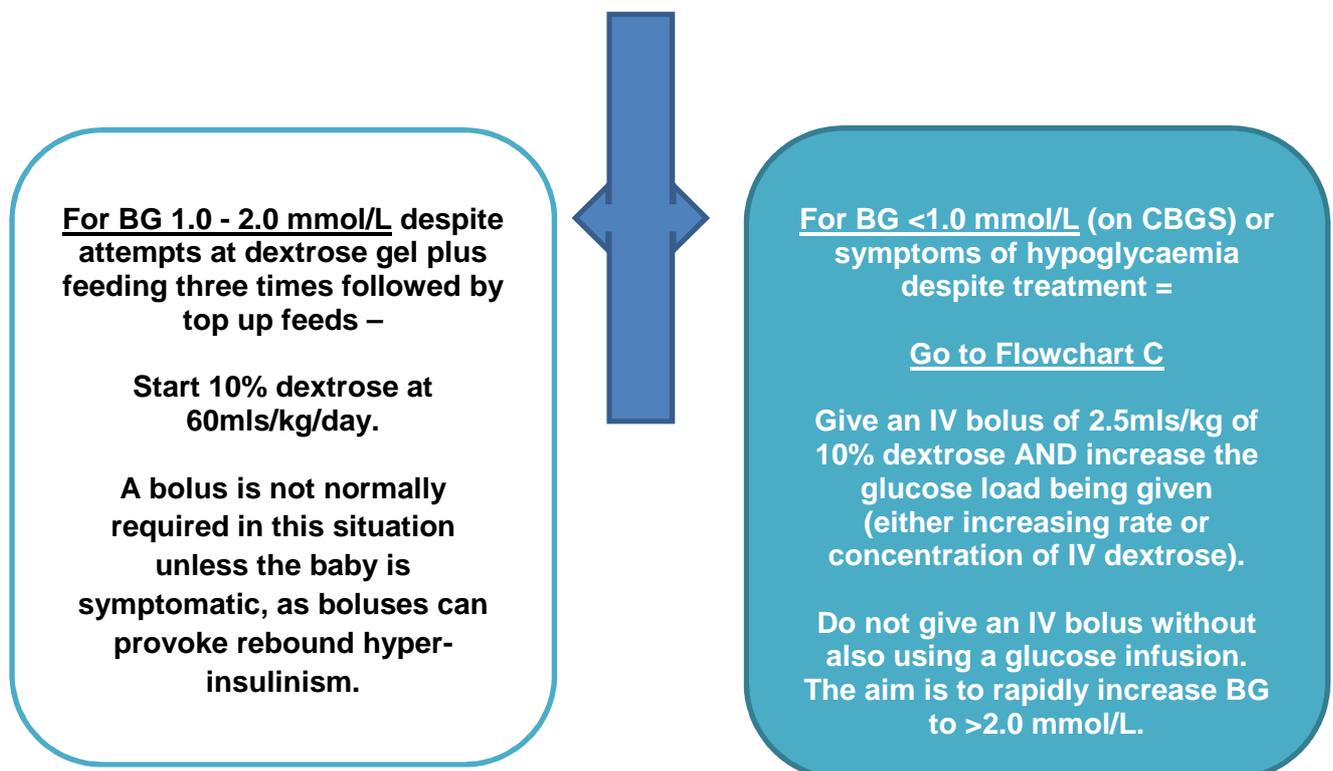
It is preferable to use enteral feeding/supplementation to IV dextrose.

NICU

Admission to NICU may be required if despite the above measures, there is:

- Persistent asymptomatic hypoglycaemia
- Intolerance of enteral feeds
- Failure to maintain normoglycaemia with appropriate enteral feeds

Blood tests required will depend on the clinical scenario (see Hypo Screen Section).



[Use the glucose infusion calculator to increment glucose.](#)

[To increase the concentration of dextrose use the “5 and 50” regime and online calculator](#)

- If the concentration of dextrose required >12.5% this must be given through a central line (UVC/long line)
- At all stages document the amount of glucose being given in mg/kg/min
- A common cause of hypoglycaemia in these circumstances is a tissue/leaking IV line.
- The attending/on call consultant should be informed of all infants with persistently severely hypoglycaemia and of infants requiring >8mg/kg/minute IV glucose

Once BG >2.5 mmol/L for 24 hours, reduce IV fluids and increase enteral fluids as appropriate every 6 hours, checking blood sugars 4 hourly. Once on full enteral feeds check BG every 6 hours for 24 hours, then cease testing if BG consistently >2.5mmol/L. Use clinical judgement to decide when testing can be ceased.

“5 & 50” glucose regime

- By running 5% and 50% dextrose as simultaneous infusions, glucose load (mg/kg/min) and flow rate (mls/hr) can be independently adjusted.
- If final glucose concentration is >12.5%, run infusion through a central line (UVC or long line).
- Electrolytes can be added to these infusions – the total desired amount (in mmol/kg/day) added to both infusions, calculated for both as if run at the full total daily volume (mls/kg/day).

For example, 4mmol/kg/day NaCl desired at 120mls/kg/day would need 16.6mmol NaCl to be added to one 500ml bag of fluid. Therefore add 16.6mmol NaCl to BOTH the 5% dextrose and 50% dextrose bag as if each would run at 120mls/kg/day). 120mls/kg/day will be delivered by a combination of the 5% and 50% dextrose depending on the glucose load required but regardless of the final glucose concentration 4mmol/kg/day of NaCl will be delivered – NB if total fluid volume changes then recalculation of added electrolytes will be required.

Hypoglycaemia Screening

Perform hypoglycaemia screening for a metabolic cause in babies with severe hypoglycaemia (<1.0mmol/L)

OR

Persistent hypoglycaemia **not** responding to adequate feeding/fluid management with requirements >8mg/kg/minute (e.g. 3 measures 1.0-1.9 **despite** adequate top up feeds or IV fluid management >8mg/kg/minute)

Screen when baby is hypoglycaemic but do **NOT** delay treatment

FIRST LINE (all eligible babies)

- Lab Glucose (grey bottle)
- FBC, LFTs, TFTs
- Blood gas with lactate
- Insulin level [speak to biochemist - emphasise urgent sample, same day result needed]
- Cortisol
- Growth hormone
- Urine dip test for ketones

Consider sepsis screen

SECOND LINE (discuss with attending consultant)

- Ammonia (speak to biochemist in advance & needs to go to lab immediately on ice)
- Lactate
- Fatty acids
- Ketone bodies
- Carnitine and acetylcarnitine (on neonatal blood spot)
- Amino acids
- Urine organic acids

Further testing such as lumbar puncture for CSF glucose depends on the clinical scenario / history.

High insulin levels with hypoglycaemia and no urinary ketones indicates hyperinsulinism. In hyperinsulinism, it is not unusual to have a glucose requirement of 15-20mg/kg/min

Some babies may benefit from Infatrini formula or SMA High Energy (Hydrolysed) for extra glucose intake. This should be discussed with the attending Consultant and (if possible) the Dietitian first.

Treatment with diazoxide / chlorthiazide should be considered (by the attending Consultant). Total fluids should be reduced to 120mls/kg/day as diazoxide may cause fluid retention. Dr Shailini Bahl (Paediatric Consultant with Special Interest in Diabetes and Endocrinology at ASPH) will advise on management.

Glucagon for Severe Hypoglycaemia

Glucagon (100mcg/kg IM) may be required in the following situations:

- Unable to gain IV access in newly admitted infant with symptomatic hypoglycaemia
- Loss of IV access in presence of significant/symptomatic hypoglycaemia
- Persistence of hypoglycaemia despite increasing glucose infusion rate
- Presence of seizures and hypoglycaemia
- Rarely an IV bolus or infusion of glucagon might be needed. Rates of 15-30 mcg/kg/hr can be given IV or subcutaneously

Follow up

All **significantly** symptomatic babies and those who have required more than 8mg/kg/min of glucose infusion should be followed up as outpatients. Please discuss with the attending Consultant. Inpatient MRI brain should be considered in severe hypoglycaemia <1.0mmol/L.

Further Reading

- [British Association of Perinatal Medicine. Identification and Management of Neonatal Hypoglycaemia in the Full Term Infant – A Framework for Practice - April 2017](#)
- Harris DL et al. Dextrose gel for neonatal hypoglycaemia (the Sugar Babies Study): a randomised, double-blind, placebo controlled trial. *The Lancet* 2013; 302: 2077-2083
- Stewart C, Sage E, Reynolds P. Supporting 'Baby Friendly': a quality improvement initiative for the management of transitional neonatal hypoglycaemia. *Arch Dis Child Fetal Neonatal Ed* 2015;0:F1–F4
- [UNICEF UK Baby Friendly Initiative. http://www.unicef.org.uk/BabyFriendly/Health-Professionals/going-baby-friendly/](http://www.unicef.org.uk/BabyFriendly/Health-Professionals/going-baby-friendly/)
- Medicine BAoP. *Newborn Early warning Trigger and track (NEWTT) - a Framework for Practice*. 2015.

Guideline Prepared by Dr E. Dunn & Dr P. Reynolds August 2017

Appendix 1

Intravenous Dextrose Concentration

Flow Rate of 10% Dextrose (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

How to calculate mg/kg/min from ml/kg/day for any concentration of glucose:

Formula: Rate (ml/kg/day) / 144 x glucose% = mg/kg/min

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

$LV = V - HV$

Add HV ml and LV ml to get V ml of D%

Appendix 2

IUGR – Birth Weight on 2nd Centile

Birth Weight on 2nd Centile (kg)		
Gestational Age/Weeks	Male	Female
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

Table 1 - Second Centile Birth Weights for Boys and Girls by week of gestation (from BAPM Newborn Early Warning Trigger and Track Framework for Practice)