Guidelines for the Prevention and Management of Hypoglycaemia

1. The Care Plan for Prevention of Hypoglycaemia on Labour Ward and the Postnatal Ward for newborn babies is available separately to this guideline. Staff must be familiar with both guidelines as they are complementary.

2. Babies should be managed according to their predicted risk of hypoglycaemia – LOW or HIGH

What is hypoglycaemia?

Hypoglycaemia is a blood sugar level (BSL) of <2.6mmol/L

Severe hypoglycaemia is a BSL <1.5mmol/L and is potentially serious, requiring immediate treatment

How do we measure BSL?

Portable glucose meters are usually the first way that a baby will have a BSL checked. Low or borderline readings on portable glucose meters should be checked by a capillary blood sugar on the blood gas machine on NICU. This is because portable methods are less accurate at extremes of blood sugar readings. Please use the abbreviation BSL for blood sugar level, not BM

How do we aim to prevent hypoglycaemia in newborn babies?

Hypoglycaemia needs to be anticipated and prevented

- Keep babies warm and dry
- Offer feeds early (high risk babies, within 30 minutes of birth)
- Within 30-60 min after birth if breast feeding, within 3 hours for all babies
- 3 hourly for high risk babies
- If suck is poor consider EBM or formula feed via NGT / OGT / cup

High risk babies should be identified by the midwife on labour ward and the “Prevention of Hypoglycaemia Care Plan” commenced (printed out, filled in and placed in the notes)
**LOW RISK INFANTS**

Normally grown term infants on the postnatal wards who are well, not cold and feeding do not require BSL testing. Infrequent feeding in a well infant is not an indication for BSL testing – it is quite usual for a baby to feed as few as 4 times in the first 24 hours postnatally, but a baby should not go for longer than 8 hours between feeds.

Good practice centres on the anticipation and prevention of hypoglycaemia and the early establishment of enteral feeds.

If a baby becomes unwell, or there are signs such as
- Poor tone
- Excessively sleepy
- Irritability
- Apnoea or seizure

then BSL should be tested and the Neonatal SHO should be called to review the baby.

**HIGH RISK INFANTS**

**RISK FACTORS FOR NEONATAL HYPOGLYCAEMIA**

**Common Postnatal Causes of Hypoglycaemia**

- Prematurity (< 37 weeks)
- Small for Gestational Age (below 2.5kg or below 2\textsuperscript{nd} centile or IUGR appearance)
- Post-mature infants (>42 weeks)
- Infant of diabetic mother including gestational diabetes
- Large for dates (>4.5kg)
- Polycythaemia
- Hypothermia (axillary temperature < 36°C)

High risk babies must have a “Prevention of Hypoglycaemia Care Plan” commenced by the midwife. Very early feeding is a mainstay of this.
1) **High Risk Babies on Labour Ward and the Postnatal Ward / Transitional Care – Prevention of Hypoglycaemia Care Plan**

*If the portable glucose measurement is < 2.6 mmol/l check BSL using the NICU blood gas machine (if latter not working send a sample to the lab in a fluoride oxalate tube)*

Breast milk is best to preserve ketone usage and stabilise blood sugars earlier. Breast fed babies can have formula top-ups either by cup or nasogastric tube with maternal agreement

- **Offer 1st feed** within 30 minutes of birth, if unsuccessful try again within 1 hour. If no feed taken, check BSL. If feed taken, check BSL prior to 2nd feed.

- If the BSL is < 2.6 mmol/l (but >2.0 mmol/l) at 2 – 4 hours of age the baby should be breast or formula fed (depending on the mother’s preference) every 3 hours until the pre-feed BSL is > 3 mmol/l on two consecutive occasions.

- If BSL remains >2.6 mmol/l but <3 mmol/l and the baby continues to be asymptomatic, increase the feed volume (see below) and/or frequency (max 2 hrly).

- **Suggested amounts for formula fed babies at risk of hypoglycaemia:**
  - 90 mls/kg on first day (i.e. “feeding a day ahead”)
  - 120 mls/kg on second day
  - 150 mls/kg on the third day onwards

- If the BSL is between 2.0 and 2.6 mmol/l, close surveillance should be maintained and admission to Transitional Care or Neonatal Unit will be required if BSL remains below 2.6 mmol/l despite frequent appropriate volume feeds or if abnormal clinical signs develop.

- If BSL is < 2.0 mmol/l at 2 – 4 hours of age after an adequate feed, call Neonatal SHO as the baby may require admission to Transitional Care or Neonatal Unit

- **Continue feeding with breast milk if possible.** Enteral feeding is preferable to IV fluids. Parents should be informed about the use of formula feeds if intending to breast feed. Parents can be reassured that short term formula usage does not predispose to development of allergies (de Jong *et al*).

**NOTES:**

1. Most babies can be managed with enteral feeds if close attention is paid to their care from early on. They may need 120 mls/kg of breast milk/formula given as frequently as 2 hourly. Once IV dextrose is commenced the process of adaptation from fetal to extra uterine life and the achievement of normoglycaemia is prolonged.

2. Babies admitted to transitional care may have nasogastric tubes passed to ensure that adequate enteral feeds are taken, and this option should always be considered to keep mothers and babies together

3. If IV dextrose is needed milk should always be continued unless there is a contra-indication.

4. If the baby is vomiting exclude other causes, e.g. sepsis or consider change to more frequent smaller volume feeds
2) Management of infants with intravenous dextrose

Any baby who has persistent symptoms, is not tolerating enteral feeds, or is unable to maintain normoglycaemia with appropriate enteral feeds alone should be commenced on an intravenous infusion of 10% dextrose.

- Blood tests needed will depend on the clinical scenario.
- Babies on IV dextrose should still receive enteral feeds if no contraindications.
- Normal neonatal hepatic production rate of glucose is between 4–6 mg/kg/min.
- If the baby is admitted to the Neonatal Unit for low BSL following recent delivery despite attempts at enteral management (BSL <2.6 mmol, >2.0 mmol/l) commence 10% dextrose at 90 ml/kg/day. This gives 6.25 mg/kg/min of glucose. Do not give a bolus at this point unless there are severe symptoms e.g. fits, baby unresponsive since bolus treatment can provoke an undesirable insulin response.
- IV bolus 3 mls/kg 10% dextrose should only be given if BSL measured on blood gas machine is <2.0 mmol/l and the baby has not responded to previous treatment or there are severe symptoms. Always increase concentration of glucose infusion as well. Aim is to rapidly raise the BSL above 2.0 mmol/l
- In infants already on IV dextrose increase glucose infusion in steps of 2 mg/kg/min (approx 30 mls/kg/day of 10% dextrose).
- Check the blood glucose 30 mins after initiation of treatment and then at 2 hours. If recovered, reduce frequency of BSL testing.
- If BSL is still low increase glucose intake by either increasing the volume or concentration. Do not increase volumes of fluid greater than 120 ml/kg/day in the first day postnattally, risk of dilutional hyponatraemia.
- Use the 5% and 50% dextrose regime ([5 & 50 Online Calculator](#)). See below about how to add electrolytes if desired
- If BSL is not maintained, increase the concentration of glucose rather than the volume. If concentration exceeds 12.5% of dextrose, insert a long line or UVC
- If further severe episodes of hypoglycaemia occur a further bolus of 3 ml/kg 10% dextrose can be given. Never give this alone. Continuous low blood glucose warrants a careful search to identify the causes as well as treatment with increased glucose intake.
- At every stage document the amount of sugar the baby is receiving in mg/kg/min.
- Inform attending or on call consultant of all babies with persistent hypoglycaemia, and those requiring >12mg/kg/min of intravenous glucose. (See below for further guidance)
- Once BSL> 3 mmol for 24 hours, reduce IV fluids and increase enteral feeds as appropriate every 6 hours, check BSL 4 hrly. On full enteral feeds check BSL 6 hrly for 24hrs, then 12hrly for 24hrs, then cease testing if BSL consistently > 3 mmol/l

“5 and 50” glucose regime:

1) By running 5% and 50% dextrose as simultaneous infusions, the amount of glucose (mg/kg/min) and the flow rate (ml/hr) can be independently adjusted
2) If the final glucose concentration is >12.5%, then the infusion should be run through a UVC or long line
3) Electrolytes can be added to these infusions – the total desired (mmol/kg/day) added to both infusions, calculated for both as if run at the full total daily volume (ml/kg/day). For example, 4mmol/kg of sodium desired at 120ml/kg/day – calculate separately for both 5% and 50% infusions as if both run at 120ml/kg/day, and add calculated sodium to both. 120ml/kg/day will then be delivered by the combination of both the 5% and 50%, regardless of the final glucose delivery concentration.
### Management of Persistent Hypoglycaemia

- If a baby requires glucose infusion rates of greater than 8 mg/kg/min, insert a central line (long line / umbilical venous catheter).
- If baby remains hypoglycaemic despite increasing glucose infusion rate to 12 mg/kg/min, take blood (preferably at the time baby is hypoglycaemic but do **not** delay treatment) for:
  - Blood glucose (lab)
  - Insulin level (levels done at Royal Surrey County Hospital on Wednesdays, Charing Cross on Tuesdays, GOSH every day: check with SPH laboratory first)
  - Cortisol
  - Growth hormone
  - Urinary ketones

- A high insulin level during hypoglycaemia indicates hyperinsulinism. Urine will be negative for ketones. Consider the diagnosis of hyperinsulinism if a history of maternal diabetes is not forthcoming.
- In cases of hyperinsulinism it is not unusual to see babies requiring 15 – 20 mg/kg/min of glucose.
- Blood sugars should remain >3 mmol/l. If normoglycaemia is achieved and the sugars stabilise, attempt to wean the glucose requirement by 1 mg/kg/min (start cautiously) every 6 - 12 hours
- Some babies may benefit from Infatrini formula for extra glucose intake. This should be discussed with the attending Consultant and (if possible) the dietitian first. Use the [Nutritional Calculator](#) to work out glucose delivery rates.
- Treatment with diazoxide/chlorothiazide should be considered by the attending consultant. Total fluids should be reduced to 120ml/kg/day as diazoxide may cause fluid retention. Dr. Bahl will advise on management and Dr. K Hussein at GOSH may be contacted if advice / transfer is required for refractory cases

### Emergency Treatment of Hypoglycaemia

- If the baby is symptomatic (unrousable, seizures etc) or the blood glucose is persistently < 2.0 mmol/l give an IV bolus of 3 mls/kg of 10% dextrose immediately followed by an infusion of 10% dextrose. Do not give boluses without subsequent IV infusion.
- Hypoglycaemia may need to be treated with glucagon in the following situations:
  - Unable to gain IV access in a newly admitted infant with symptomatic hypoglycaemia
  - Loss of IV access in the presence of significant/symptomatic hypoglycaemia.
  - Persistent hypoglycaemia in spite of increasing glucose infusion rate.
  - Presence of seizures and hypoglycaemia

- The dose of glucagon is 100 mcg/kg given intramuscularly if no intravenous access. It can also be given as an IV bolus.
- Rarely an infusion of glucagon might be needed. Rates of 15 – 30 mcg/kg/hr can be given IV or subcutaneously

Use the online [Nutritional Calculator](#) to work out energy and glucose intakes for babies on IV fluids and enteral feeds
Babies of Women with Diabetes (also called Infants of Diabetic Mothers)

- Should remain under hospital supervision until they are at least 24 hrs old, are maintaining blood glucose levels and are feeding well.
- Should have a cardiac review including echocardiography if they have clinical signs of congenital heart disease or cardiomyopathy, including murmur. The timing of this will depend on clinical circumstances.
- Babies of women with diabetes should be admitted to the neonatal unit if they have:
  - Persistent and significant hypoglycaemia (see guideline)
  - Respiratory distress persisting for >1 hr
  - Signs of cardiac compromise
  - Signs of neonatal encephalopathy
  - Polycythaemia
  - Severe jaundice
  - Born before 35 weeks
  - Birthweight over 4.5kg

Follow Up

- All significantly symptomatic babies and those who have required more than 12mg/kg/min of glucose infusion should be followed-up. If uncertain discuss with attending consultant on ward round.

References