

Implementation of Oral Dextrose Gel in the Management of Neonatal Hypoglycaemia

Dr Wong Siu-Chun Mabel

Consultant, Queen Mary Hospital

MBBS (HK), MRCP (UK), MRCPCH, FHKAM(Paediatrics), FHKCPaed

Neonatal hypoglycaemia is a leading cause of newborn admission to the Neonatal Care Unit and mother-newborn separation. The traditional treatment for neonatal hypoglycaemia has involved formula supplementation or administering intravenous glucose. However, these practices can hinder the establishment of breastfeeding (BF) and disrupt the natural bond between the mother and her newborn. Evidence shows that formula supplementation negatively affects an infant's gut flora for up to 4 weeks. For infants with a predisposition to certain allergies, formula given during the first few days of life can sensitise a neonate to cow's milk proteins and lead to dairy allergies later in life. In addition, early exposure to cow's milk proteins present in formula may increase an infant's risk of developing insulin-dependent diabetes mellitus.^{1,2} The negative impact of standard neonatal hypoglycaemia treatment on BF and its disruption of continuous mother-newborn contact, and the possible risk of formula feeds prompted our team to look for alternative interventions.

Why Dextrose Gels?

Oral dextrose gel contains dextrose, a simple carbohydrate, in concentrated aqueous solution. In 2013, Harris et al published the results of a randomised controlled trial showing the efficacy of buccal administration of dextrose gel in reversing hypoglycaemia in neonates with negligible risks.³ This method of administration was found to be particularly effective because the high vascularization of the mucosa allowed an absorption rate similar to that of intravenous administration. Their study

showed that using 40% dextrose gel with feeding was more effective in reversing neonatal hypoglycaemia than feeding alone, did not require admission, and was compatible with exclusive BF.³ In addition, this treatment was found to be simple to administer, cost effective, well tolerated, and not



associated with any adverse effect. Further, because the administration of dextrose gel helps maintain normal glucose levels, a protocol using glucose gel reduces the necessity of supplemental feedings and therefore supports exclusive BF overall.

The Cochrane Review (2016) concludes that **treatment of infants with neonatal hypoglycaemia with 40% dextrose gel reduces the incidence of mother-infant separation for treatment and increases the likelihood of full BF after discharge** compared with placebo gel. No evidence suggests occurrence of adverse effects during the neonatal period or at two years' corrected age. Oral dextrose gel should be considered the first-line treatment for infants with neonatal hypoglycaemia.⁴

Planning and Implementation Strategies

With the available strong evidence, we tried to incorporate the use of dextrose gel into our existing *guideline on prevention and management of neonatal hypoglycaemia* with the aim to reduce mother-infant separation and formula supplementation and also encourage sustained BF. We initiated a multidisciplinary and cross-departmental discussion among the neonatal, obstetric and clinical pharmacy colleagues and all agreed that the **use of dextrose gel should be the standard treatment for neonatal hypoglycaemia**. Our existing guidelines on screening and management of neonatal hypoglycaemia was revised with the incorporation of dextrose gel. Before the use of dextrose gel, we used formula 10 ml/kg to treat mild hypoglycaemia.

Revision of the Management Protocol for Hypoglycaemia in the First 48 Hours (Figure 1)

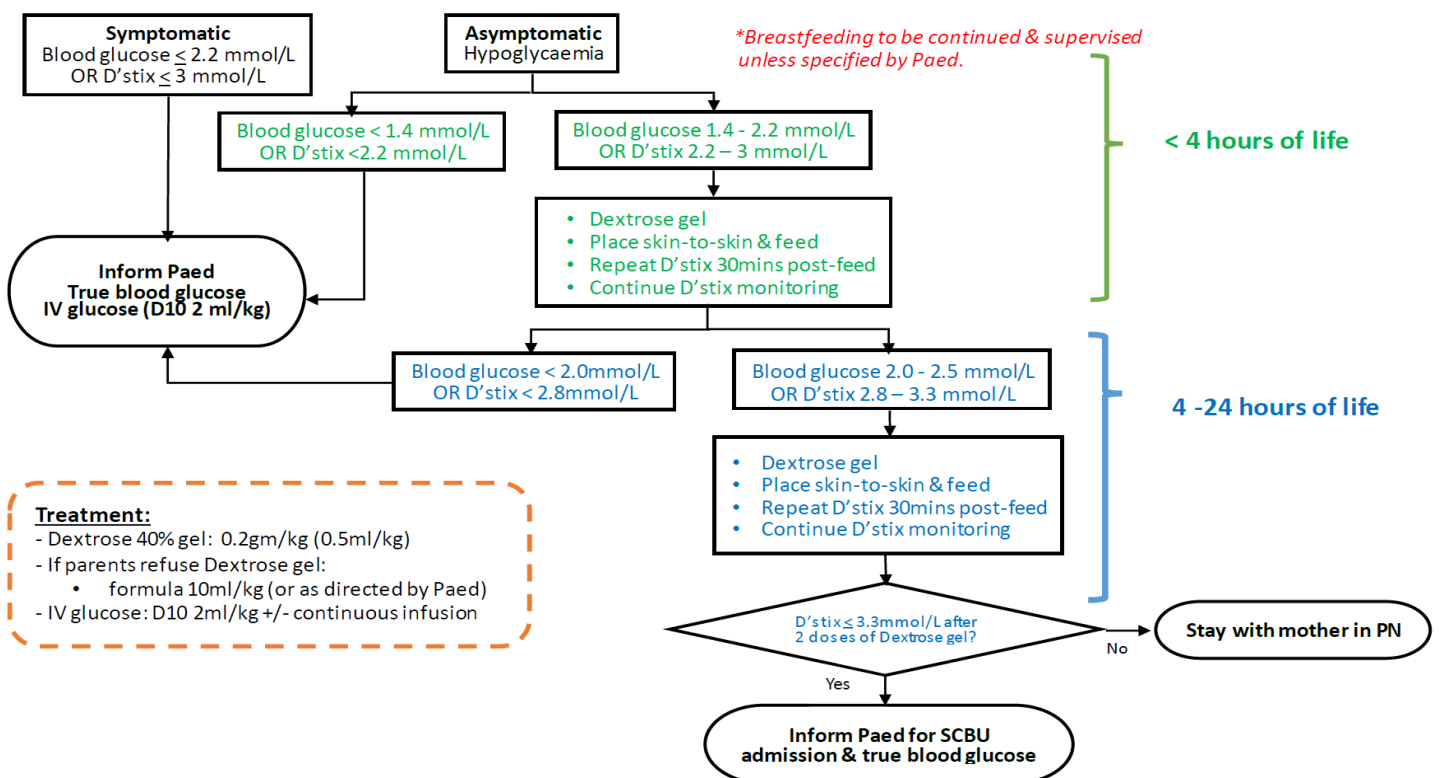


Figure 1. Clinical Pathway for the management of hypoglycaemia in term or late preterm infants ≥ 35 weeks in the first 48 hours

Neonatal blood glucose concentration decreases after birth and reaches a nadir at around 2 – 3 hours of life. It then rises and stabilises by 12 hours of life. Some newborns have an impaired counter-regulatory

response to low blood glucose and are at risk of developing hypoglycaemia and need monitoring of blood glucose. The gold standard of blood glucose measurement is plasma glucose. For the sake of rapid detection and timely treatment of hypoglycaemia, bedside reagent test-strip glucometer is used for screening. For the glucometer used in our unit, 99% of the test strip results fall within +/- 0.8 mmol/L of the plasma glucose value. The first blood glucose screening is done at 2 – 3 hours of life when blood glucose is at the lowest. We adopt an operational threshold of plasma glucose 2.2 mmol/L for babies <4 hrs of life and 2.5 mmol/L for those >4 hrs of life as suggested by the latest American Academy of Pediatrics (AAP) guidelines.⁵ Newborns under blood glucose monitoring should not be separated from their mothers unless clinical conditions warrant more intensive monitoring or treatment in the neonatal unit (Table 1). Standard baby care including thermoregulation and skin-to-skin care should be practiced to avoid hypoglycaemia. Breastfeeding should be started early, given frequently and supervised constantly (Table 2).

Table 1. Infants at risk of hypoglycaemia – Routine monitoring of blood glucose	
Rooming in with mother in postnatal ward	Admission to neonatal unit
Maternal Diabetes with suboptimal glycaemic control, e.g., infants being large for gestational age, polyhydramnios, mothers requiring obstetric interventions due to diabetes	Maternal Diabetes requiring insulin
Late Preterm 35 – 36 6/7 weeks	Preterm <35 weeks
Birth Weight (BW) \geq 90 th percentile	
Small for Gestational Age (SGA) (5 – 10 th percentile) with BW 2.3 – 2.5kg	BW < 2.3kg BW < 5 th percentile
Maternal Drug use e.g., beta blockers, high glucose infusion during labour	Perinatal asphyxia Neonatal sepsis Restricted / poor feeding Significant polycythaemia Severe Rh incompatibility

Table 2. Caring for “at risk” babies
<ul style="list-style-type: none"> - Skin-to-skin contact and early feeding (within 1 hr), then frequent on-demand feeding every 2 to 3 hours - Supervise BF. If direct BF is difficult, give expressed breastmilk by cup & teach mother to express - Keep warm - Monitor vital signs (heart rate, respiratory rate, temperature every 8 hours and as indicated) - Blood glucose monitoring - BF is encouraged during dextrose gel and intravenous glucose therapy

As the standard of care, mild hypoglycaemia (blood glucose 1.4 – 2.2 mmol/L or Dextrostix 2.2 – 3 mmol/L within 4 hours; or blood glucose 2 – 2.5 mmol/L or Dextrostix 2.8 – 3.3 mmol/L after 4 hours) is treated with dextrose 40% gel followed by placing the newborn skin-to-skin with mother for early feeding. If parents refuse dextrose gel, immediate feeding with 10 ml/kg milk (breastmilk is preferable, formula if breastmilk is not available) should be given. BF should be continued and supervised. Repeated dose of dextrose gel can be given to newborns at 30 minutes after feeding if there is persistent hypoglycaemia.

Prompt intervention is necessary for newborns who manifest clinical signs and symptoms of hypoglycaemia (Table 3). These newborns require immediate admission to the neonatal unit for treatment and close monitoring. We treat symptomatic newborns with intravenous glucose using an arbitrary cutoff of blood glucose lower than 2.2 mmol/L (or Dextrostix <3 mmol/L). Intravenous glucose should also be given to newborns with asymptomatic hypoglycaemia if blood glucose is <1.4 mmol/L (Dextrostix 2.2 mmol/L) in the first 4 hours of life or <2.0 mmol/L (or Dextrostix <2.8 mmol/L) after 4 hours of life or if there is recurrent hypoglycaemia refractory to 2 doses of dextrose gel or 2 feeds of milk at 10 ml/kg.

Table 3. Clinical manifestations of hypoglycaemia	
- Irritability, tremours, jitteriness	- Cyanosis
- Exaggerated Moro reflex	- Apnoea or irregular breathing
- High-pitched cry	- Tachypnoea
- Seizures / myoclonic jerks	- Hypothermia / temperature instability
- Lethargy, listlessness, limpness, hypotonia	- Poor sucking or refusal to feed
- Coma	

Prescription and Administration of Buccal 40% Dextrose Gel

Our clinical pharmacists helped to source 40% dextrose gel and establish weight-based dosing of dextrose gel (Table 4). Standardization of the prescription via Inpatient Medication Order Entry (IPMOE) system was performed. The team also worked out the logistic and standing order to guide clinical management including the standard way of gel administration. The desired amount of dextrose gel is drawn up using an oral syringe. Both sides of the baby's buccal mucosa are dried with clean gauze. One quarter of the dose is administered at a time to either the right or left buccal cavity. The baby's cheek is massaged to stimulate absorption. The steps are repeated on alternate sides until completion of the dose.

Table 4. Weight-based Dosing Guide for 40% Dextrose Gel							
BW (kg)	2	2.5	3	3.5	4	4.5	5
Dose (ml)	1	1.25	1.5	1.75	2	2.25	2.5
Dose (gm)	0.4	0.5	0.6	0.7	0.8	0.9	1

Education & Training

Our breastfeeding coordinators provided education and training to all nursing staff working in neonatal, obstetric and labour wards on the use of dextrose gel. An information pamphlet on dextrose gel was also compiled for parents (Figure 2). The use of dextrose gel is first introduced in the antenatal talk. The information pamphlet would be provided to parents at risk of delivering newborns with neonatal hypoglycaemia with explanations on the possible need for glucose gel before delivery.

Figure 2. Information Pamphlet

(https://www3.ha.org.hk/hkwc/ppi/InfoPam/docs/paed/paed_16.pdf)



Data Review & Way Forward

Full implementation of dextrose gel was started in August 2020 with trial running and streamlining of workflow. Compliance was reviewed regularly. We conducted a brief review in 2022. The total number of deliveries in the year 2022 was 2,127. One hundred and fifty-nine (7.5%) of them were at risk of neonatal hypoglycaemia. Seventy-one (45%) of the at-risk newborns were observed in the postnatal ward and 8 (11%) of them required admission to neonatal unit for persistent hypoglycaemia not responsive to 2 doses of dextrose gel. With the smooth implementation of dextrose gel, the way forward was to have all at-risk newborns monitored in the postnatal ward to further reduce mother-newborn separation and promote BF.

Summary

Neonatal hypoglycaemia is a leading cause of admission to neonatal units. Dextrose gel is a safe and effective intervention to treat neonatal hypoglycaemia. With multidisciplinary efforts, we incorporated dextrose gel into the management protocol which could actively support exclusive BF by minimising unnecessary mother-newborn separation and reducing formula supplementation.

Key Messages:

1. Neonatal hypoglycaemia is a leading cause of newborn admission to the Neonatal Care Unit and mother-newborn separation.
新生兒低血糖是嬰兒入住新生兒護理病房及母嬰分離的主要原因。
2. The routine practices of formula supplementation and intravenous glucose administration to treat neonatal hypoglycaemia hinder the establishment of breastfeeding and disrupt the natural bond between the mother and newborn.
以補充配方奶和靜脈注射葡萄糖治療新生兒低血糖的常規做法會阻礙母乳餵哺的建立，以及破壞母嬰之間的自然關係。
3. Studies have shown that 40% dextrose gel with feeding was more effective in reversing neonatal hypoglycaemia than feeding alone, did not require admission, and was compatible with exclusive breastfeeding. It should be a standard treatment for mild neonatal hypoglycaemia.
研究顯示，使用40%葡萄糖凝膠輔以餵哺，相比單獨餵哺更有效地逆轉新生兒低血糖，並且無需入院，又與全母乳餵哺相容，應用作輕度新生兒低血糖的標準治療方法。
4. Our experiences demonstrate the importance of collaborative efforts among neonatologists, obstetricians, midwives, postnatal nurses, neonatal nurses and clinical pharmacists in the successful implementation of dextrose gel use in neonatal hypoglycaemia.
我們的經驗顯示了新生兒科醫生、產科醫生、助產士、產後護士、新生兒科護士和臨床藥劑師之間的通力合作對於成功實施葡萄糖凝膠治療新生兒低血糖的重要性。

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