Neonatal Hypoglycaemia

Contents

1. Overview

Purpose

The purpose of this guideline is to provide evidence-based recommendations for staff and LMCs caring for a neonate at risk of hypoglycaemia.

Scope

All Maternity clinical staff and Maternity Facility Access Holders, Registered Nurses, and Medical Practitioners working within the maternity and newborn services at WDHB

2. Background information

Hypoglycaemia is a common metabolic problem in neonates. A prolonged period of hypoglycaemia, particularly if associated with clinical signs and symptoms can have an adverse impact on brain development.

The fetus is entirely dependent on transplacental glucose. After birth, the newborn has to maintain blood glucose levels independently. Healthy term babies often feed infrequently in the first 24-48 hours after birth; they manage this without ill effect because they are able to mobilize energy stores through a process known as counter-regulation. Blood glucose concentrations normally fall in the first 1-2 hours after birth, and then begin to rise again as babies mobilise their body stores of fat and glycogen and begin to feed. The physiological fall itself is thought to be necessary to release hormones such as glucagon in order to stimulate glycogenolysis and gluconeogenesis, thereby attaining normal glucose homeostasis.

In some babies, this physiological fall in blood glucose does not correct and, if undetected and untreated, may potentially cause significant hypoglycaemia leading to brain damage.

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Some newborns are at risk of developing hypoglycaemia, either because of inadequate supply of glucose (e.g. decreased hepatic glycogen stores) or increased glucose utilization (cold stress, infection, hyperinsulinism. All 'at risk' infants need to be monitored closely, regardless of mode of feeding.

3. At risk infants

- Preterm babies (<37 weeks)
- Small babies, <2.5kg or small for gestational age (SGA) with birthweight at or below 9th centile*
- Large babies, >4.5kg
- Diabetes in pregnancy
- Apgar score <7 at 5 minutes
- Hypothermia
- Neonates with haemolytic disease
- Neonatal syndromes (e.g. Beckwith-Wiedemann syndrome)
- Maternal drug treatment (e.g. Propanolol, Prozac (Fluoxetine), illicit drug abuse)

⚠ * To calculate centile use the UK-WHO Neonatal and Infant close Monitoring (NICM) weight charts Measuring Neonatal and Infant Growth

4. Clinical manifestations

Newborns with hypoglycaemia may be asymptomatic or may present with nonspecific clinical manifestations:

- Jitteriness
- Hypothermia
- Irritability
- Feeding intolerance
- Vomiting
- Changes in levels of consciousness: lethargy, stupor, coma
- Apnoea, cyanotic episodes
- Hypotonia, limpness
- Tremor
- Seizures

Neonatal hypoglycaemia may be an early sign of other significant disease processes requiring further investigation and treatment.

⚠ Any baby showing clinical signs of hypoglycaemia must be reviewed by the paediatric team urgently

5. Definition of hypoglycaemia

- Blood glucose < 2.6 mmol/L, a blood glucose ≥ 2.6 mmol is considered safe for most infants
- An episode of hypoglycaemia is defined from the first blood glucose < 2.6 mmol/L until resolution with a blood glucose ≥ 2.6mmol/L.

6. Management of infants at risk

6.1 Screening for hypoglycaemia

The following babies should be screened for hypoglycaemia (see flow charts for more details)

- All infants that have clinical signs of hypoglycaemia

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- All "at risk" infants
- In SCBU, at least daily blood glucose testing on all infants on intravenous fluids

Screen using the iSTAT analyser, if no analyser is available a laboratory sample must be sent. Follow up blood glucose measurements are always indicated to confirm that the infant can maintain normal glucose levels over several feed-fast cycles

6.2 Care at birth

- Identify risk factors
- Take steps to avoid hypothermia as this can result in hypoglycaemia. Ensure the birth room is warm
- Dry the baby, encourage immediate skin to skin contact and cover with a warm blanket. Preferably this is with the mother but if not possible, with the support person
- All babies should remain skin to skin for at least an hour, watch for feeding cues and assist mother, if needed, to breastfeed
- commence a neonatal observation chart and record temperature, respirations and responsiveness 3-4 hourly

6.3 Feeding

- Encourage a feed within the first hour after birth. Educate the mother about feeding cues and how to recognise and anticipate cues so baby can be offered the breast when showing signs of hunger, even when this occurs less than 3 hours since last feed
- Express and give EBM (expressed breastmilk) if baby does not initiate feeding, maintain skin to skin care to support baby's temperature regulation and reduce hypothermia
- Aim for frequent feeds at least 8-12 in a 24 hour period
- Assess frequency and effectiveness of feeds and document breastfeeding score on feed chart
- Where feeding at the breast is not achievable, the mother must be encouraged to hand express 2-3 hourly and offer baby EBM

Note: If BMS is required an appropriate volume (5ml/kg/feed) is offered by spoon/cup in the first instance. The indication for the prescription of BMS must be discussed with the parents when required (e.g. not in advance) and documented.

6.4 Monitoring of blood glucose

- Check blood glucose at 1-2 hours of age
- If glucose between 1.2-2.5 mmol/L on first testing (1-2 hours)
    - rub 0.5 ml/kg of 40% dextrose gel into buccal mucosa
    - then feed the baby (breastmilk only)
    - recheck glucose within 30min
- Check blood glucose subsequently 3-4 hourly, preferably before feeds
- If glucose between 2.0-2.5 mmol/L on subsequent testing
    - rub 0.5 ml/kg of 40% dextrose gel into buccal mucosa
    - then feed the baby (breastmilk only)
    - recheck glucose within 30min
- If feeding well, monitor glucose for at least 12 hours
- Any recorded hypoglycaemia, monitor glucose for at least 12 hours after last low level

Inform paediatric team immediately if

- blood glucose <1.2mmol/L at any stage
- blood glucose < 2.0 mmol/L despite one dose of oral dextrose gel

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- blood glucose < 2.6 mmol/L despite two doses of oral dextrose gel
- if feeds are not tolerated

7. Dextrose 40% Gel - Dose and Administration

- Dextrose 40% gel (40g/100ml) must be prescribed on a medication chart either by a midwife or medical practitioner in the "once only" section
- Blood glucose concentration <2.6 mmol/L, but ≥ 1.2 mmol/L on first administration and ≥ 2.0 mmol/L on subsequent doses AND
  - ≥ 35 weeks' gestational age AND
  - < 48 hours after birth
- Dose
  - 200 mg/kg (0.5 ml/kg)
  - Maximum of 3 doses of dextrose gel to treat one episode of hypoglycaemia (defined as first blood glucose level < 2.6 mmol/L until subsequent blood glucose level> 2.6mmol/L)
  - Maximum of 6 doses of dextrose gel in 48 hours
- Administration
  - Draw up dose (0.5mL/kg) of dextrose 40% gel into an oral dose syringe
  - Dry inside of buccal mucosa with gauze
  - Apply dextrose to a gloved finger, and massage into buccal mucosa until well absorbed
- Storage
  - Store in fridge
  - Dextrose Gel 40% (Biomed Ltd) expires 30 days after opening

8. SCBU

8.1 General considerations

- If bolus feeding consider increasing frequency of feeds, continuous feeds or commencing intravenous (IV) fluids (D10%)
- If low birth weight (<2500g), intravenous 10% dextrose might be indicated, and should be initiated as soon as feasible, and always within the first 2 hours after birth
- In order to maintain blood glucose, increase fluid volume first, then dextrose concentration
- Maximum IV fluid on Day one SHOULD NOT exceed 90ml/kg/day without first consulting SMO on-call
- Infusions of dextrose of up to 12.5% may be managed with peripheral intravenous access, higher concentrations require central venous access
- Glucagon may be useful in an emergency to mobilise glycogen stores. SGA infants may not respond as well

Note: **Glucagon** can be used for emergency situations, particularly in situations where there is difficulty starting intravenous glucose infusion
Glucagon Hypokit is available in the SCBU Pyxis
http://www.adhb.govt.nz/newborn/DrugProtocols/GlucagonPharmacology.htm)

8.2 Further management for persistent or severe hypoglycaemia

- In certain at risk infants the threshold may be moved to a higher blood glucose level (e.g. 3.0 or 3.5 mmol/L) in order to provide substrate for brain metabolism
- Calculate glucose requirement > 10mg/kg/min – NW Newborn Clinical Guideline - Glucose Flow Calculator
- Diazoxide needs to be discussed with SMO on-call prior to prescribing

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- For persistent or severe hypoglycaemia the following tests are done at the time of hypoglycaemia, including a blood glucose at the same time (= paired blood glucose and insulin samples). Ammonia can be done anytime, regardless of blood glucose level
- A pre-packed specimen bag with micro-containers and a laminated instruction sheet is available in each unit (see 6.7 Tests and investigations)
- Consult with the Paediatric Endocrinology team at Starship Children's Hospital if necessary

Note: **Diazoxide** can be considered in persistent and severe hypoglycaemia (requiring more than 10mg/kg/min of glucose or lasting longer than 1 week**)**
Diazoxide 50mg/ml Oral mixture is available in SCBU Pyxis machine. This is a Section 29 drug preparation and parents should be informed that it is not registered for oral use in NZ
Consider starting chlorothiazide at the same time
http://www.adhb.govt.nz/newborn/DrugProtocols/DiazoxidePharmacology.htm

8.3 Tests and investigations

Test	Microtainer	Collection Considerations	
Glucose	Green		Tested at WDHB
Cortisol	Green or Yellow/SST		Tested at WDHB
Beta hydroxybutyrate (ketones)	Green or Yellow/SST		Tested at WDHB
Insulin*	Yellow/SST		Tested at WDHB
Growth hormone	Yellow/SST		Tested at ADHB
Free fatty acids	Purple/EDTA	sent on ice, separate to FBC if required	Tested at ADHB
Ammonia (must be sent on ice)	Green	sent on ice	Tested at WDHB
⚠ **Consult Paediatric Endocrinology team at Starship Children's Hospital** to help with interpretation			

* Hyperinsulinism – this is a very likely diagnosis, if ketones are negative, and the insulin level inappropriately high for a low blood glucose, e.g. BSL <2.2 mmol/L, insulin > 5 mU/L

To summarise minimum volumes required (total of 2.1ml):

1x heparin/green	0.6ml on ice	– for ammonia, glucose and beta-hydroxy-butarate
1x SST/yellow	0.5ml	– for insulin and cortisol
1x SST/yellow	0.5ml	– for growth hormones
1x EDTA/purple	0.5ml on ice	– for free fatty acids, (separate from FBC)

⚠ Please be aware tube requirements can change if there is a testing platform change.
The Éclair Clinical library will always be up to date.

9. Documentation

- A care plan must be documented in the clinical records; this may require input from Midwife, Lactation Consultant, Charge Midwife, SCBU Nurse , paediatric medical staff
- Ensure that the infant has a feed chart and a neonatal observation chart
- Ensure that the plan is evaluated and after any treatments are re-evaluated
- Parental consent must also be documented

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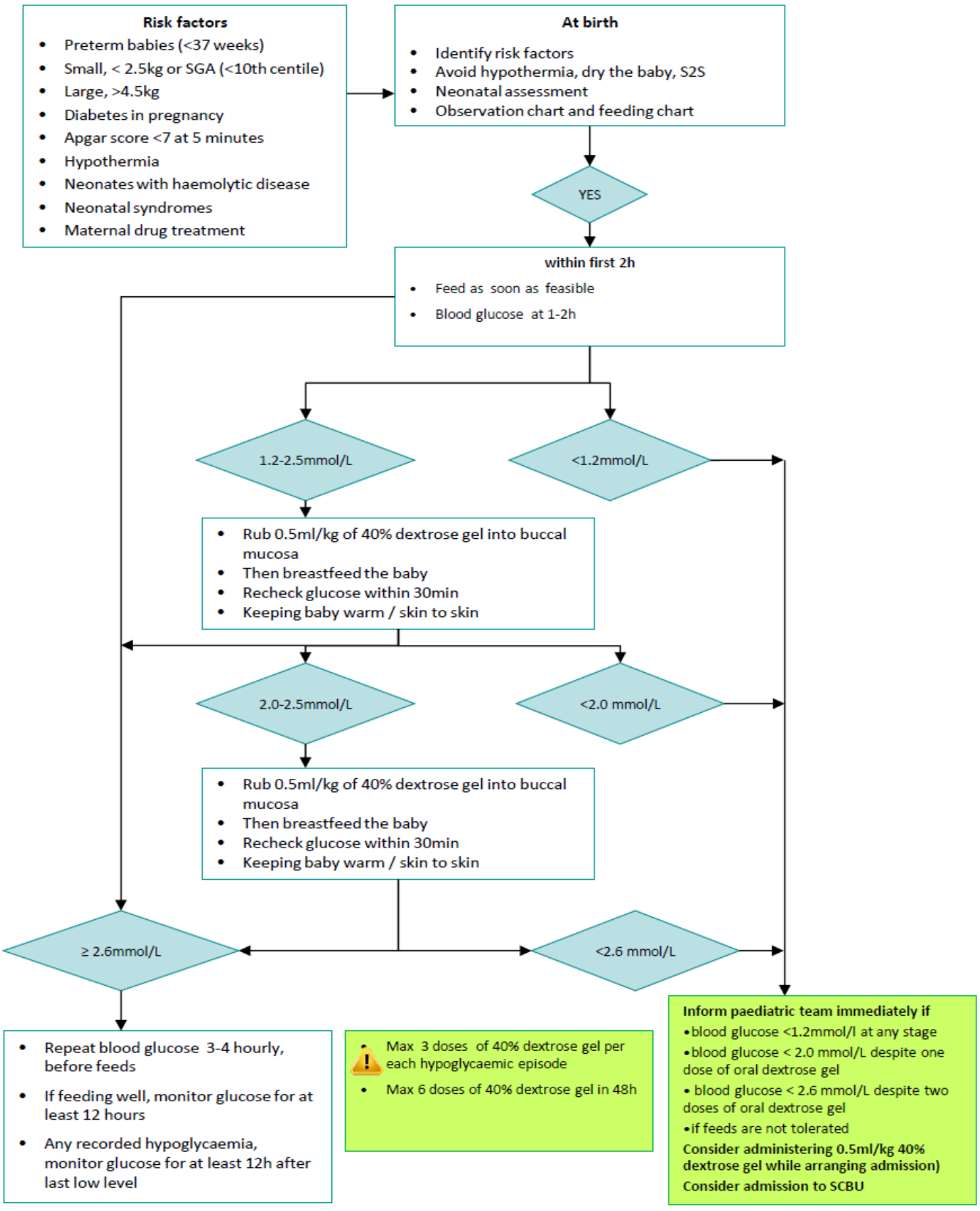
10. Flowchart 1: Management for at risk infants (>35/40, <48h of age)



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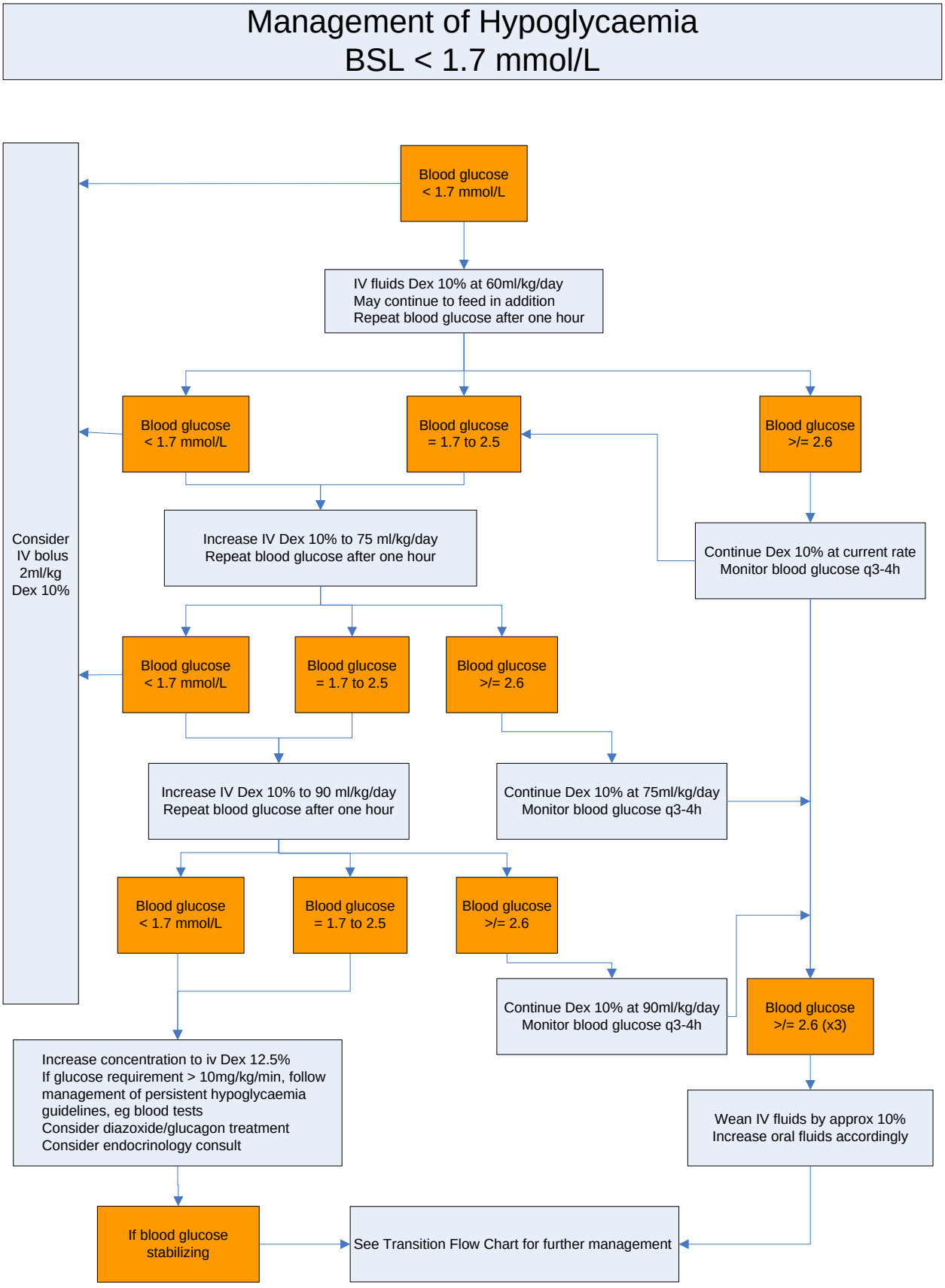
11. Flowchart 2: SCBU management of hypoglycaemia, BSL < 1.7mmol/L



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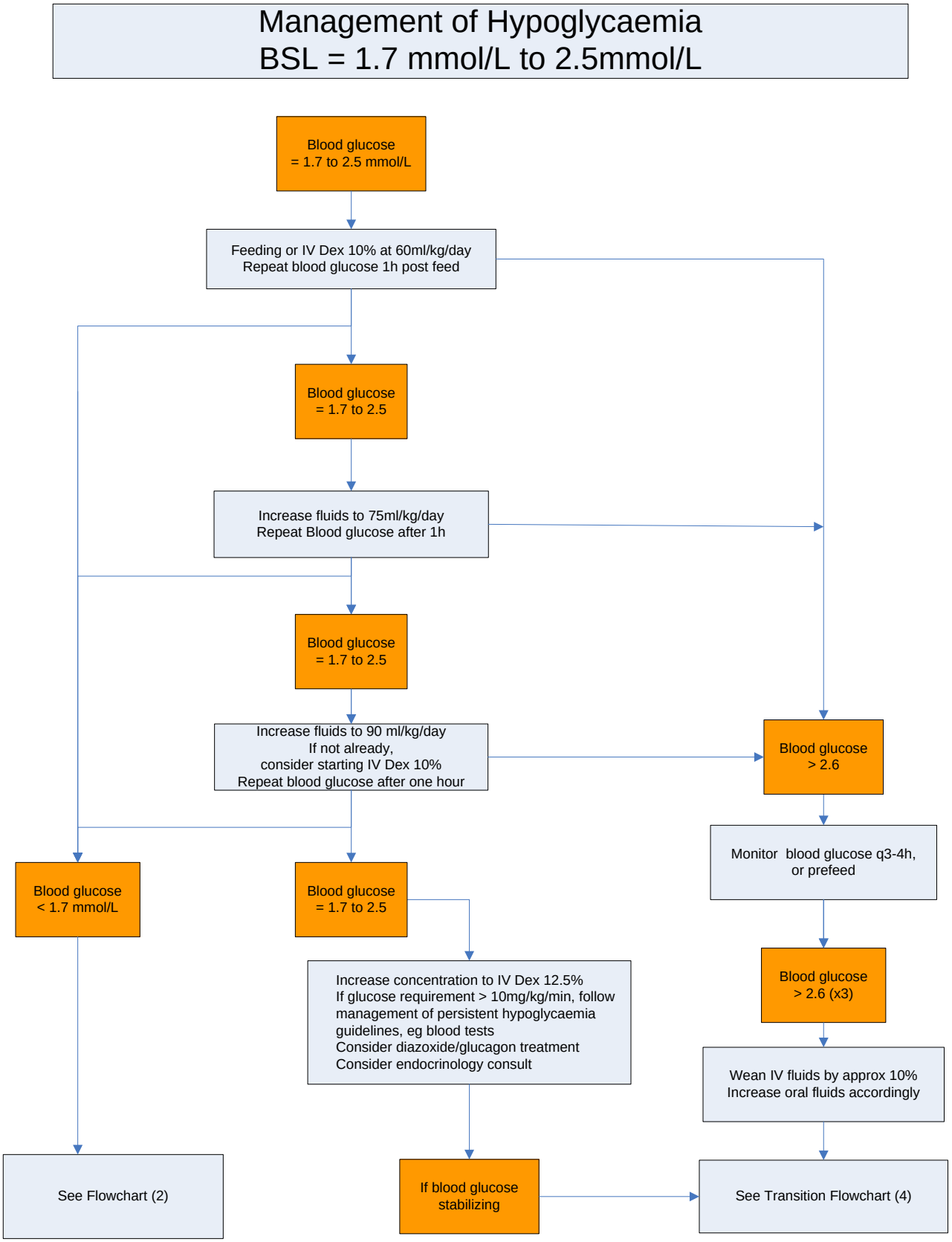
12. Flowchart 3: SCBU management of hypoglycaemia, BSL = 1.7 to 2.5mmol/L



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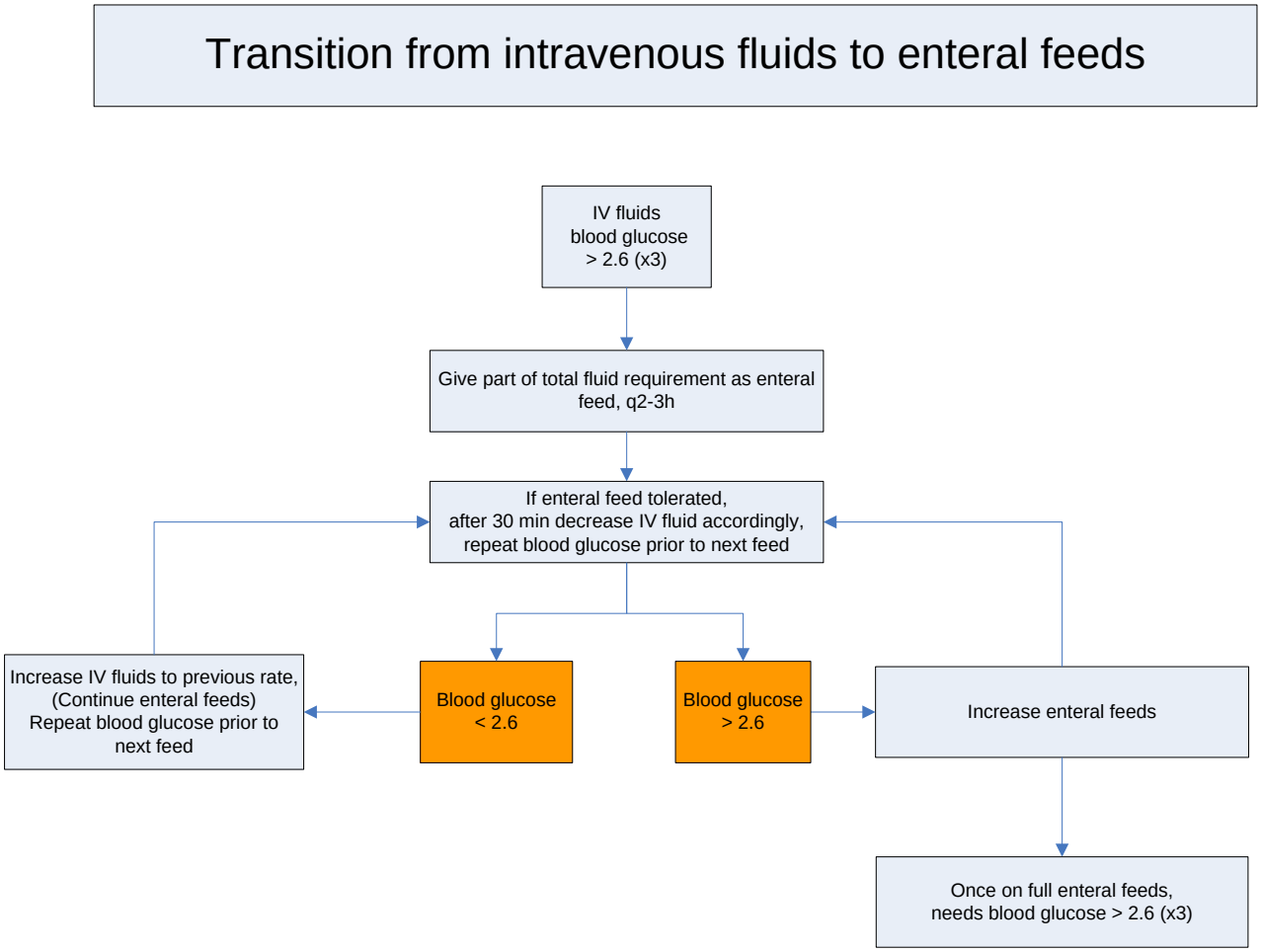
13. Flowchart 4: Transition from intravenous fluids to enteral feeding



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14. References

Type	Title/Description
Waitemata DHB Guideline	• Measuring Growth in Neonates and Infants
NCYCN dextrose gel practice recommendation	• https://www.starship.org.nz/media/334440/practice_recommendations_dextrose_gel.pdf
National Women's Health, ADHB	• ADHB Newborn Services – Guideline for the management of hypoglycaemia, 2013 http://www.adhb.govt.nz/newborn/Guidelines/Nutrition/HypoglycaemiaManagement.htm • ADHB Newborn Services – Dextrose gel, 2014http://www.adhb.govt.nz/newborn/DrugProtocols/Dextrose%20Gel.htm
Articles	• McKinlay C, et al. Neonatal Glycaemia and Neurodevelopmental Outcomes at 2 Years, NEJM 373:1507-18 • Harris D, Weston P, Harding J. Incidence of neonatal hypoglycaemia in babies identified as being at risk. J Pediatr. 2012;161:787-91. • Deborah L Harris, Philip J Weston, Matthew Signal, J Geoffrey Chase, Jane E Harding. Dextrose gel for neonatal hypoglycemia (the Sugar Babies Study): a randomized, doubleblind placebo-controlled trial. Lancet 2013; 382:2077-2083 • Deshpande S, Ward Platt M. The investigation and management of neonatal hypoglycaemia. Semin Fetal Neonatal Med 2005;10:351-61 • Committee on F, Newborn, Adamkin DH. Postnatal glucose homeostasis in late-preterm and term infants. Pediatrics 2011;127:575-9 • McCowan L, Stewart AW, Francis A, Gardosi J. A customised birthweight centile calculator developed for a New Zealand population. Aust NZ J Obstet Gynaecol. 2004; 44: 428-431 • ABM Clinical Protocol #3: Hospital Guidelines for the Use of Supplementary Feedings in the Healthy Term ABM Clinical Protocol #1:Guidelines for Blood Glucose Monitoringand Treatment of Hypoglycemia in Term and Late-Preterm Neonates, Revised 2014http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4026103/#!po=23.3333 • Breastfed Neonate, Revised 2009 Breastfeeding Medicine. Volume 4, Number 3, 2009 www.bfmed.org • Am J Perinatol. 2008 May;25(5):283-9. Epub 2008 Apr 24.Blood glucose determinations in large for gestational age infants. Van, Storms MR. • de Rooy L, Hawdon J. Nutritional factors that affect the postnatal metabolic adaptation of full-term small- and large-for-gestational age infants. Pediatrics 2002; 109:E42. • Two hour blood glucose levels in at-risk babies: An audit of Canadian guidelines, Jennifer Croke BSc, Meagan Sullivan BSc, Anne Ryan-Drover FRCPC, Ed Randell PhD, Wayne Andrews FRCPC, Khalid Aziz FRCPC FRCPCH Paediatric Child Health Vol 14 No 4 April 2009
Unicef	Guidance on the development of policies and guidelines for the prevention and management of Hypoglycaemia of the Newborn, 2010
Guideline	Canadian Paediatric Society, Screening guidelines for newborns at risk for low blood glucose. Paediatric Child Health. Vol9 No 10 December 2004
UK Baby Friendly, UNICEF,	Guidance on the development of policies and guidelines for the prevention and management of Hypoglycaemia of the Newborn August 2010
Best Practice, Evidenced based information sheets for health professionals	Management of asymptomatic hypoglycaemia in healthy term neonates for nurses and midwives.