Royal Hospital for Women (RHW)
NEONATAL BUSINESS RULE
COVER SHEET

Health
South Eastern Sydney
Local Health District

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SUMMARY	Early recognition of high-risk neonates and management of neonatal hypoglycaemia
Key Words	Hypoglycaemia, blood glucose level, dextrose/glucose treatment, Neonate, monitoring, management

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Neonatal Hypoglycaemia

RHW CLIN154

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Within this document we will use the term woman, this is not to exclude those who give birth and do not identify as female. It is crucial to use the preferred language and terminology as described and guided by each individual person when providing care.

1 BACKGROUND

Neonatal hypoglycaemia, defined as blood glucose level (BGL) of <2.6mmol/L, is a common and preventable condition in neonates. It can lead to significant brain injury and poor neurological outcomes if left untreated. Early identification of high-risk neonates, awareness of signs and symptoms, timely investigations to detect hypoglycaemia and appropriate interventions to maintain normoglycaemia are the cornerstone of preventing neonatal neurodevelopmental adverse outcomes from this metabolic condition.

2 RESPONSIBILITIES

2.1 Nursing / Midwifery

- Monitor and manage for clinical symptoms
- Initiate and perform capillary BGL
- Support early breastfeeding within half an hour of birth
- Assist mother in breast feeding and identify factors that contribute to ineffective feeding
- Escalate to Neonatal Team if BGL is <2.6mmol/L
- Continue to monitor BGL until medically stable as per flowcharts (Appendix 1-3)

2.2 NCC Medical

- Identify high risk neonates
- Differential diagnosis of presented clinical symptoms, rule out other conditions and/or sepsis causing hypoglycaemia
- Inform nursing/midwifery personnel to commence hypoglycaemia protocol
- Manage and treat neonatal hypoglycaemia as per the flowcharts (Appendix 1-3)
- Consult Sydney Children's Hospital Endocrine team for neonates with refractory hypoglycaemia

2.3 Sydney Children's Hospital Endocrine Team

- Provide consultation and management plan for neonates with refractory hypoglycaemia

3 PROCEDURE

3.1 Equipment

- Single-use lancet (heel-prick device) (appropriate size for neonate)
- Glucometer (bedside glucose monitor)

- Test strip (inserted into glucometer)
- ABL90 Flex Plus Blood Gas Analyser
- 45µL capillary blood sampling tube
- Blood test request form
- Blood collection tubes (yellow top, purple top, grey top)
- Bag of ice
- 70% alcohol swab for heel skin cleaning
- Sterile cotton balls
- Non-sterile gloves
- Sucrose 24% or expressed breast milk (EBM)

3.2 Clinical Practice

3.2.1 Identification of high-risk neonates

- At birth:
  - Neonatal risk factors
    - Preterm neonate <34 weeks
    - Late preterm neonate (34^{+0}-36^{+6} weeks)
    - Term neonate with intrauterine growth restriction (IUGR)
    - Small for gestational age (SGA)- birth weight less than 10th percentile
    - Large for gestational age (LGA)- birth weight greater than 97th percentile or 4500g at term
    - Perinatal hypoxia/asphyxia
    - Hypothermia/Hyperthermia
    - Hypoxia/Asphyxia
    - Respiratory Distress
    - Sepsis
    - Polycythaemia
  - Maternal risk factors
    - Gestational Diabetes Mellitus (GDM)
    - Pre-existing Diabetes Mellitus
    - Glycated Haemoglobin (HbA1c) level of ≥6.5%
    - Maternal Drug Therapy:
      - Beta blockers in the 3rd trimester and/or at the time of delivery
      - Insulin or oral antidiabetic medications
    - Beta agonists (e.g.Terbutaline)
- Post birth:
  - Hypothermia/hyperthermia
  - Polycythaemia
  - Respiratory distress
  - Sepsis
- Ongoing breastfeeding challenges after 24 hours of life
  - Difficulty latching or reluctance to feed
  - Inadequate milk supply
  - Feeding intolerance/vomiting

3.2.2 Clinical Signs and Symptoms

- Neonates are generally asymptomatic, however the ability to recognise symptoms of hypoglycaemia may lead to prevention of substantial neurodevelopmental sequelae in neonates.
- These symptoms may be present although are not exclusive to hypoglycaemia.
  - Apnoea
  - Jitteriness
  - Irritability
  - Floppiness
  - Poor feeding
  - Cyanosis
  - Weak or high-pitched cry
  - Seizures

3.2.3 Monitoring and management of hypoglycaemia

1. All neonates at delivery
   - Commence skin-to-skin contact between the mother and the neonate as soon as possible after birth.
   - Keep the neonate warm and maintain normal temperature >36.5C. Put a beanie/hat on.
   - Support early breastfeeding within half an hour of birth.
     - Assist mother to recognise feeding cues (rapid eye movements under the eye lids, mouth and tongue movements, body movements and sounds, sucking on a fist)
   - Aim for effective feeding within the first hour.
   - Monitor the neonate for any clinical symptoms of hypoglycaemia.
     - Symptoms include irritability, tremors, exaggerated Moro reflex, high-pitch cry, seizures, lethargy, floppiness, cyanosis, apnoea and poor feeding with a corresponding BGL of <2.6mmol/L
2. Neonates **at risk** of hypoglycaemia listed in Appendix 1
   - Perform a bedside capillary BGL prior to the feed at 2 hours of age
     - BGL safe level ≥2.6mmol/L
   - Continue monitoring BGL until BGL is >2.6mmol/L for 3 consecutive readings at routine screening times and no clinical signs of hypoglycaemia are present.
   - Encourage effective feeding at least every 3 hours

> Note
> Consider monitoring neonates with other risk factors for hypoglycaemia as indicated.

3. Neonates with **confirmed** hypoglycaemia (Appendix 2)
   - Defined as:
     - BGL <2.6 mmol/L with or without symptoms
   - Alert Paediatric/Neonatal Team, follow clinical emergency response systems (CERS) as per the standard neonatal observation chart (SNOC)
   - Perform a formal BGL on the blood gas analyser in NCC - DO NOT DELAY TREATMENT. FOLLOW APPENDIX 1
   - Administer 0.5mL/kg Glucose 40% if BGL <2.6mmol/L onto the neonate's dry buccal mucosa- Refer to Australasian Neonatal Medicines Formulary (ANMF) Glucose 40%.
   - Give top up feed with either breastmilk or supplementary formula feeding at 10-20mls/feed.
     - Ensure formula consent is obtained from parent/carer

- Recheck BGL in 30- 60 minutes after feed
- Continue regular breastfeeding at least 3 hourly
  - Supplementary formula top ups of 10-20mL/feed may be required if breastmilk supply is inadequate or at medical discretion
- Continue with pre- feed BGL checks
  - BGL ≥ 2.6 mmol/L – Resume feeding plan and continue BGL monitoring before each feed until BGL is >2.6mmol/L for 3 consecutive readings at routine screening times and no clinical signs of hypoglycaemia are present
  - BGL <2.6 mmol/L – Follow appendix 1 for management

4. Neonates with symptomatic or recurrent hypoglycaemia (Appendix 1, 2 and 3)
   - Refer and admit neonate immediately to NCC.
   - Give 0.5mL/kg Glucose 40% onto the neonate's dry buccal mucosa as an interim.
   - Consider IV/IM/SC Glucagon 200 microgram/kg (maximum 1 mg) while waiting for IV glucose or after IV glucose.
   - Obtain urgent intravenous (IV) access - consider screening for sepsis as well as for hyperinsulinemia (see initial studies below).
   - Give IV Dextrose 10% infusion bolus at 2mL/kg dose.
   - Commence IV infusion containing glucose 10% at or 20 mL/kg above the age appropriate fluid rate/kg/day.
   - Check BGL in 30 minutes.
     - If BGL remains <1.5mmol/L or neonate remains symptomatic
       - Give another IV glucose 10% bolus at 2mL/kg
       - Consider IV glucagon bolus (if not already given prior) or IV glucagon infusion at 5 microgram/kg/hour.
       - Increase glucose infusion rate (GIR) according to gestation ie. Preterm or Term neonate. Refer to education notes for computation of GIR
       - Repeat BGL in 30 minutes
       - Discuss with Neonatal Consultant on Call to increase concentration of dextrose solution.
       - Consider central IV access if requiring dextrose 12.5% solution and above
       - Send initial studies for hyperinsulinaemia
         - Serum Glucose and Insulin > yellow top with a serum clot activator gel
         - B-hydroxybutyrate > preferred to be in a grey top (fluoride oxalate), sent on ice
         - Serum lactate > grey top (fluoride oxalate), sent on ice
         - Serum ammonia > EDTA top, sent on ice
         - Serum cortisol > yellow top with a serum clot activator gel
         - Growth Hormone > yellow top with a serum clot activator gel
     - If still hypoglycaemic <2.6mmol/L on a higher glucose concentration.
       - Consider Glucagon infusion if not already receiving it.
       - Discuss with Endocrine Consultant on Call.

3.3 Documentation

- eRIC
- eMR Powerchart
- SNOC

3.4 Education Notes

- Maternal risk factors for neonatal hypoglycaemia include:
- Gestational Diabetes Mellitus (GDM) with Oral Glucose Tolerance Test (OGTT) results:
  - Fasting BGL ≥ 5.1 mmol/L
  - 1-hour BGL ≥ 10.0 mmol/L
  - 2-hour BGL ≥ 8.5 mmol/L
- Pre-existing Diabetes Mellitus with results of BGL:
  - Fasting BGL < 13 weeks gestation - ≥ 6.1mmol/L
  - Fasting BGL ≥ 13 weeks gestation - ≥ 5.1mmol/L
  - Random BGL ≥ 11.1mmol/L beyond 2 hours of postpartum

- Neonatal hypoglycaemia is a common metabolic condition in neonates, particularly in high-risk groups like preterm neonates, infant of diabetic mothers, SGA and LGA neonates.
- Neonatal hypoglycaemia happens as neonates transition from receiving glucose from the placenta to relying on their own glucose stores and feeding. If there are inadequate glucose stores such as preterm or growth-restricted neonates; increased glucose use such as stress in hypoxia or sepsis and delayed or poor feeding, then hypoglycaemia can occur.
- Although there is no universally agreed threshold, most guidelines from British Association of Perinatal Medicine (BAPM) as well as the American Academy of Paediatrics (AAP) define it as:
  - ≤ 2.6mmol/L (47mg/dL) in asymptomatic neonates requiring intervention
  - ≤ 2.0- 2.5mmol/L (36-45 mg/dL) as critical threshold, depending on symptoms
- Glucose 40% oral gel is a first-line, non-invasive treatment for mild to moderate neonatal hypoglycaemia in at-risk, stable neonates. It is commonly used as an interim before resorting to IV dextrose and helps maintain blood glucose while encouraging enteral/oral feeding.
- Glucose 40% oral gel increases BGL by a maximum of 0.4mmol/L.
- Glucose 40% oral gel can be given a maximum of 3 times in a 24 hour period.
- Oral feeding is not limited to breastfeeding, formula feeding at times can be used as a supplementation as first-line for mild cases. However, for severe and symptomatic cases. IV 10% Dextrose is the recommended approach.
- Glucose infusion rate (GIR) refers to the amount of glucose delivered per kg of body weight per minute. This is crucial for managing neonatal hypoglycaemia and ensuring that the neonates receive enough glucose to meet metabolic needs, especially when oral feeding is not possible or insufficient.
- The ideal glucose infusion rate for neonates differs depending on their gestation as preterm neonates' needs are higher due to limited glycogen stores[12,13].
  - Term Neonates: 4-6 mg/kg/min
- Preterm Neonates: 5-8 mg/kg/min
  - Calculating glucose infusion rate is:

$$\text{Glucose intake (mg/kg/min)} = \frac{\%\ \text{Glucose} \times \text{Volume (ml/kg/day)}}{144}$$

- In addition to common risk factors like prematurity, IUGR, IDM, recurrent or severe hypoglycaemia can be due to underlying medical conditions. Some important pathological and metabolic causes to consider are hyperinsulinism either congenital (e.g., Beckwith-Widemann Syndrome), inborn errors of metabolism (e.g. glycogen storage disease, fatty acid oxidation disorders, galactosaemia etc.), hormonal deficiencies (congenital adrenal hyperplasia, hypopituarism or growth hormone deficiencies). These conditions are highly suspicious if the

hypoglycaemia is associated with seizures, hepatomegaly or dysmorphic features and will warrant endocrinology/metabolic specialist referral.

3.5 Abbreviations

BGL	Blood glucose level	EBM	Expressed Breast Milk
IUGR	Intrauterine Growth Restriction	SGA	Small for Gestational Age
LGA	Large for Gestational Age	GDM	Gestational Diabetes Mellitus
OGTT	Oral Glucose Tolerance Test	CERS	clinical emergency response systems
SNOC	standard neonatal observation chart	ANMF	Australasian Neonatal Medicines Formulary
IV	Intravenous	TFR	Total Fluid Requirement
GIR	Glucose Infusion Rate	EDTA	Ethylenediaminetetraacetic acid

3.6 Related Policies/procedures

- RHW NCC CBR- Admission of a Neonate to Newborn Care Centre
- RHW CBR- Admission of a Neonate to Postnatal Services
- RHW NCC CBR- Deteriorating neonate - Recognition and management inside newborn care centre
- RHW CBR- Deteriorating neonate - Recognition and management outside newborn care centre
- RHW NCC CBR- Enteral Nutrition - preterm neonates 1000g and under
- RHW NCC CBR- Enteral Nutrition - preterm neonates 1001-1500g
- RHW NCC CBR- Enteral Nutrition - preterm neonates 1501-1800g
- RHW NCC CBR- Enteral Nutrition - neonates greater than 1800g
- RHW NCC CBR- Golden Hours Protocol - Management of Preterm Neonates <32 weeks in the first 2 hours of life
- RHW NCC CBR- Heel prick for blood sampling
- RHW NCC CBR- Intragastric Tube Insertion and Maintenance
- RHW NCC CBR- Intravenous Line Management
- RHW CBR- Neonatal Withdrawal and Toxicity
- RHW CBR- Neonatal abstinence from antidepressants during pregnancy
- RHW CBR- Neonatal Observations Guideline outside newborn care centre
- RHW CBR- Neonatal CERS - Management of the Deteriorating NEONATAL inpatient (CERS)
- RHW NCC CBR- Peripheral Intravenous Cannula Insertion and Dressing
- RHW NCC CBR- Umbilical Catheterisation - Insertion
- RHW NCC CBR- Umbilical catheters - Securement and Management
- ANMF- Glucose 40%
- ANMF- Glucagon
- RHW Drug Formularies- Higher Dextrose Concentration Solution Preparation *

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4 ABORIGINAL HEALTH IMPACT STATEMENT DOCUMENTATION

- Considerations for culturally safe and appropriate care provision have been made in the development of this Business Rule and will be accounted for in its implementation.
- When clinical risks are identified for an Aboriginal and/or Torres Strait Islander woman or family, they may require additional supports. This may include Aboriginal health professionals such as Aboriginal liaison officers, health workers or other culturally specific services

5 CULTURAL SUPPORT

- For a Culturally and Linguistically Diverse CALD woman, notify the nominated cross-cultural health worker during Monday to Friday business hours
- If the woman is from a non-English speaking background, call the interpreter service: NSW Ministry of Health Policy Directive PD2017_044-Interpreters Standard Procedures for Working with Health Care Interpreters.

6 NATIONAL STANDARDS

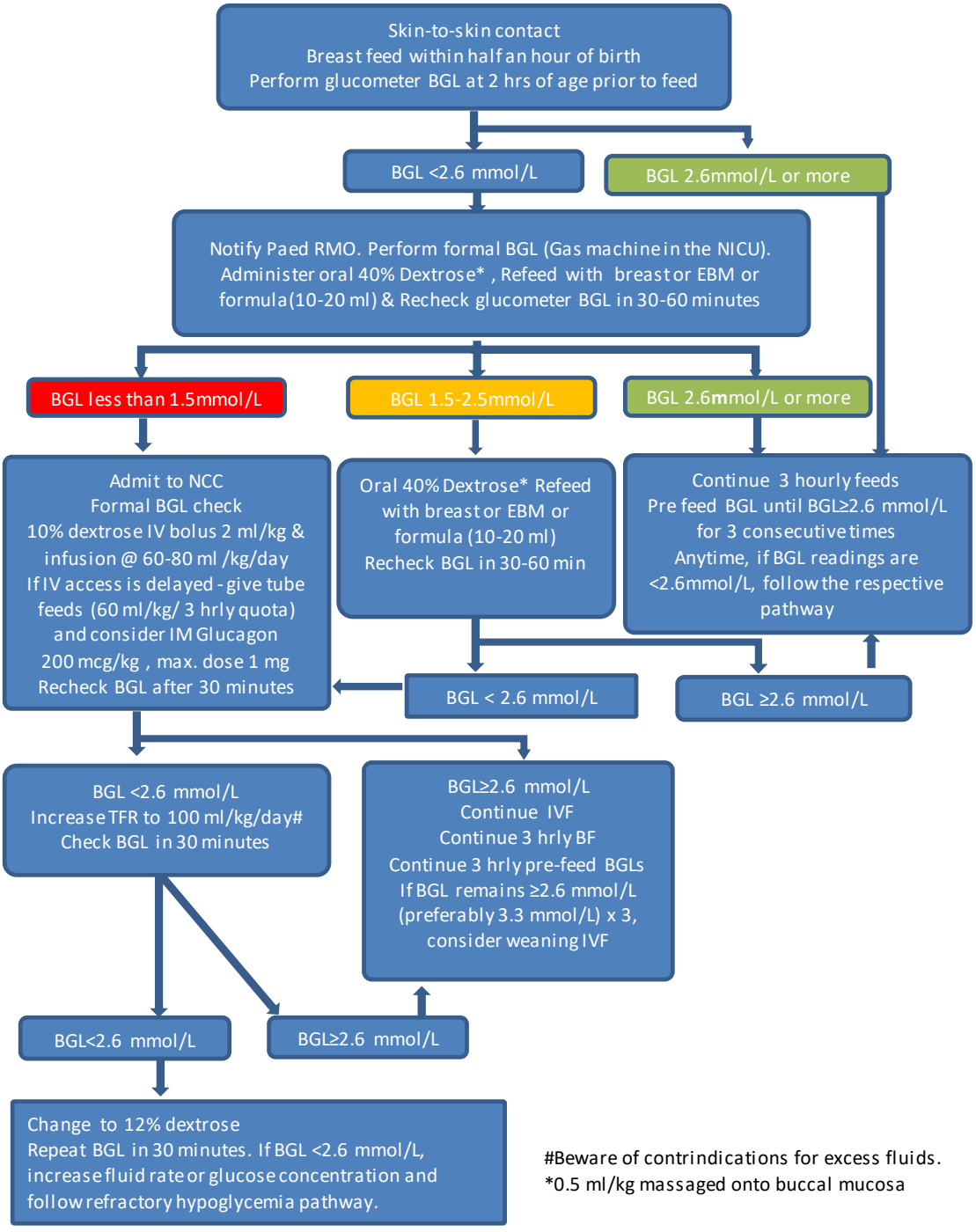
- Standard 1 Clinical Governance
- Standard 2 Partnering with Consumers
- Standard 5 Comprehensive Care
- Standard 6 Communicating for Safety
- Standard 8 Recognising and Responding to Acute Deterioration

7 REVISION AND APPROVAL HISTORY

Date	Revision No.	Author and Approval
01/02/2005	1	Endorsed by Neonatal Clinical Committee Approved by Quality Council of RHW
19/02/2013	2	P Patel (Neonatal Fellow), S Bolisetty (Neonatal Staff Specialist), Obstetric Physicians RHW, Endocrine and Metabolic team of SCHN Endorsed by Therapeutic & Drug and Maternity Services LOP Committees
2018	3	Reviewed and endorsed by NCC LOPs Committee
10/03/2025 26/06/2025	4	Fatima Anne M Perez (NICU Fellow) Endorsed by NCC CBR Committee
21.7.25	4	RHW BRGC
4.9.25	5	Revision by S Bolisetty, C Byron, S Whelan, R Jackson

Appendix 1 Asymptomatic Neonates at risk of hypoglycaemia

Appendix 1. Asymptomatic Infants at risk of hypoglycaemia
(Maternal diabetes, late preterm (34^{+0}-$36^{+6/7}$), Term SGA and LGA, birthweight ≥4.5 Kg)



#Beware of contrindications for excess fluids.
*0.5 ml/kg massaged onto buccal mucosa

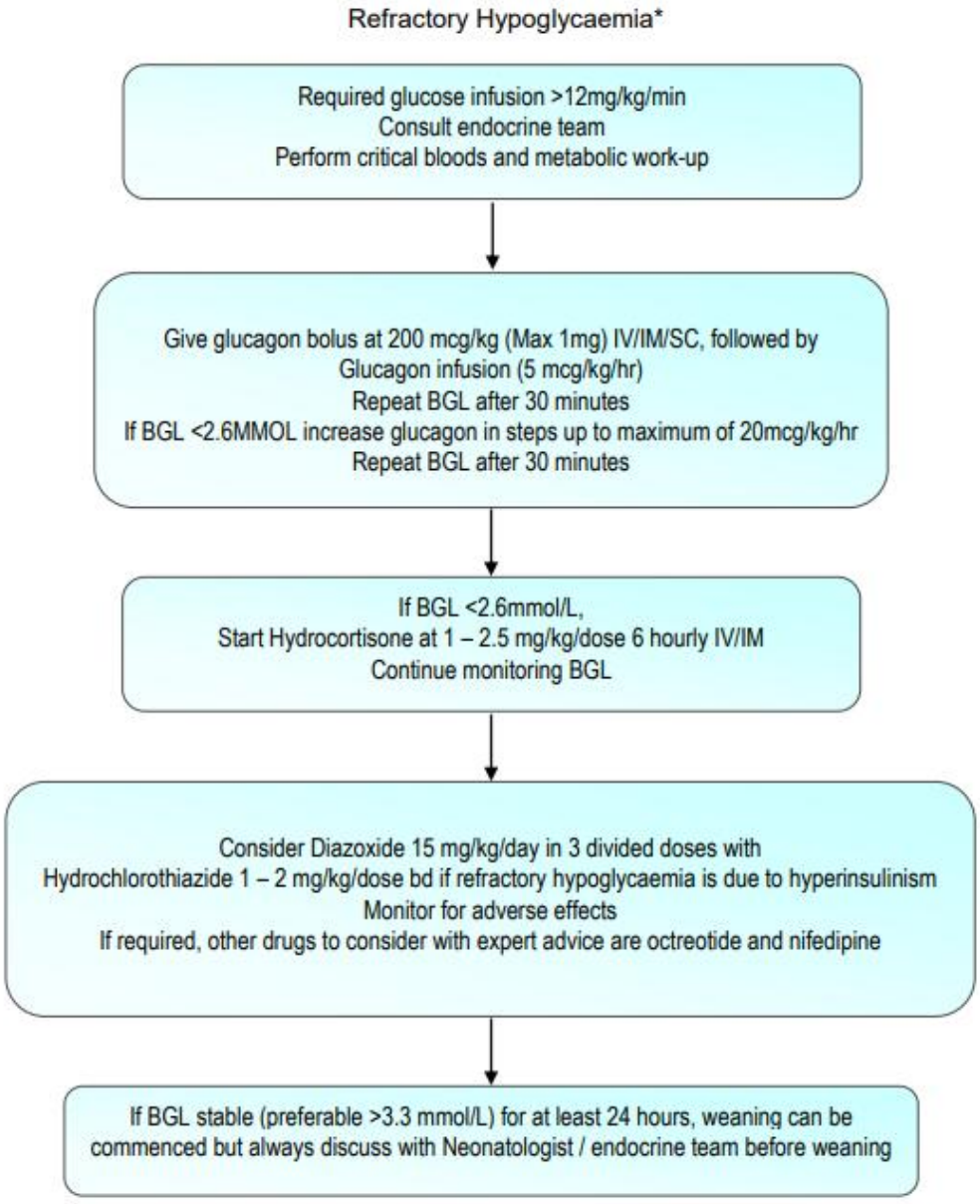
Appendix 2. Symptomatic Hypoglycaemia

Symptomatic Hypoglycaemia*

Urgently check formal BGL
Administer 40% dextrose if oral solution allowed
Insert cannula, give 10% Dextrose IV bolus at 2ml/kg and commence IV
Dextrose infusion at age appropriate fluid rate
Repeat BGL after 30 minutes

*Symptomatic hypoglycaemia: Defined as symptoms including irritability, tremors, exaggerated Moro reflex, high-pitch cry, seizures, lethargy, floppiness cyanosis, apnoea and poor feeding with a corresponding BGL of <2.6mmol/L

Appendix 3. Refractory Hypoglycaemia



* Refractory Hypoglycaemia is defined as Hypoglycaemia requiring infusions of a large amount of glucose (>12 mg/kg/min) to maintain normoglycaemia