Hypoglycaemia - Infant Management

1. Purpose

This guideline outlines the requirement for management of hypoglycaemia in infants at the Women's.

2. Definitions

Hypoglycaemia: There is a lack of consensus on a definition of neonatal hypoglycaemia. It is recommended that clinical practice be guided by operational thresholds (i.e. blood glucose levels at which clinical interventions should be considered).

Clinical signs which suggest clinically significant hypoglycaemia are non-specific and include jitteriness, irritability, high pitched cry, cyanotic episodes, apnoea, seizures, lethargy, hypothermia, hypotonia or poor feeding. Many babies with hypoglycaemia will have no clinical signs.

Operational threshold

- Post-natal wards:
    - Well infants with risk factors for hypoglycaemia, but no clinical signs:
        - During the first 24 hours: blood sugar level < 2.0 mmol/L
        - After 24 hours: blood sugar level < 2.6 mmol/L.
    - Infant with clinical signs: **blood sugar level** < 2.6 mmol/L
    - Newborn Intensive and Special Care
    - All infants**: true blood glucose** < 2.6 mmol/L.

Blood Sugar Level (BSL): as measured by a blood glucose monitor and reagent strips in Birth Centre and postnatal wards. These measurements are less accurate at lower BSL. Therefore a TBG should be performed for any BSL < 2.0 mmol/L during the first 24 hours or <2.6 mmol/L thereafter if no clinical signs, or BSL < 2.6 mmol/L if clinical signs are present.

True Blood Glucose (TBG): as measured on a blood gas analyser in Newborn Intensive and Special Care or by laboratory measurement.

3. Responsibilities

All medical and nursing/midwifery staff caring for newborn infants, including infant of a mother who has diabetes.

4. Guideline

Do not measure blood glucose levels in well, term infants.

Monitor infants with risk factors for hypoglycaemia, including:

- maternal indications:
    - mother who has diabetes.
- infant indications:
    - All low birthweight infants (<2,500gm) , regardless of gestation
    - Small for gestational age infants (<10th centile), as per table below
    - Macrosomic or large for gestational age infants (>90th centile), as per table below.

Birth gestation (completed weeks)	10th centile (grams)	90th centile (grams)
36	2300	3300
37	2450	3600
38	2600	3800
39	2800	4000
40	2900	4200
41	3100	4400

- Clinically wasted infants, regardless of birthweight
- Infants admitted to Newborn Intensive and Special Care with:
  - CNS depression at birth or encephalopathy
  - rhesus isoimmunisation
  - polycythaemia
  - sepsis
  - respiratory distress
  - prematurity
  - nil orally.

4.1 Infants of mothers who have diabetes

Inform neonatal RMO of impending birth of an infant of a mother who has diabetes. After birth, neonatal RMO to decide whether the infant should be managed in the postnatal ward or Newborn Intensive and Special Care.

Transfer infant of a mother who has diabetes to Newborn Intensive and Special Care if:

a. Maternal indications:

- poor control during pregnancy (most recent HbA1c > 7.5%)
- BSL > 8 mmol/L during labour
- IV glucose during labour.

b. Infant indications:

- unwell (e.g. signs of respiratory distress)
- macrosomic (>90th centile)
- Small for gestational age infants (<10th centile), low birthweight infants (<2,500gm) or clinically wasted regardless of birthweight
- Preterm (<37 weeks gestation)
- Other reason(s) for admission to Newborn Intensive and Special Care.

All other well infants of mothers who have diabetes (type 1, type 2 or gestational diabetes, controlled by insulin or diet) should be transferred to the postnatal ward with their mother. Refer to: Infants at Risk for Hypoglycaemia: Management in Birth Centre and Postnatal - Appendix 1.

Note: Mother managed with insulin prior to or during pregnancy is not an indication alone for transfer of infant to Newborn Intensive and Special Care.

For management of infants transferred to Newborn and Intensive Special Care, refer to: Management of Infants with Risk Factors for, or Diagnosis of, Hypoglycaemia – Appendix 2 in this guideline.

4.2 Management of infants at risk for hypoglycaemia in Birth Centre and postnatal wards

Commence feeding within one hour of birth and feed 3 – 4 hourly.

Measure Blood Sugar Level (BSL):

- At four hours of age or before the second feed (whichever comes first)
- Immediately if clinical signs of hypoglycaemia are present
- Before each subsequent feed until 3 consecutive readings ≥2.6 mmol/L, or as requested by neonatal RMO.

Recommence glucose monitoring if change in feeding or clinical condition.

Note: Confirm any BSL reading < 2.0 mmol/L (infant with no clinical signs during first 24 hours) or < 2.6 mmol/L (infant with clinical signs and/or after 24 hours of age) with a TBG (NISC or laboratory) measurement. Do not wait for result before responding.

If BSL is 1.5-1.9 mmol/L during first 24 hours or 1.5-2.5 mmol/L thereafter in infant with no clinical signs:

- Inform neonatal RMO
- Massage 0.5mL/kg of 40% glucose gel into buccal mucosa – refer to Neonatal Medicine Protocol
- Feed infant and complement this feed only with EBM/formula (5-10mL/feed); if this occurs twice, consider supplementing each feed
- Feed infant 3 hourly
- Continue to measure BSL before feeds.

Notify neonatal RMO and arrange immediate transfer to Newborn Intensive and Special Care if:

- Any BSL < 1.5mmol/L
- Any BSL < 2.6mmol/L and clinical signs
- 2 consecutive BSL 1.5-1.9 mmol/L during first 24 hours or 1.5-2.5 mmol/L thereafter (no clinical signs) despite 2 dose of oral glucose gel (or if feeds not tolerated by baby).

40% glucose gel may be nurse/ midwife initiated for up to 2 doses and ordered on the 'ONCE ONLY MEDICINES' section of the Neonatal Medicines chart (MR/410).

After medical review, the neonatal RMO may order a further 4 doses of 40% glucose gel (maximum 6 doses administered in first 48 hours after birth).

Refer to Appendix 1 for Infants at Risk for Hypoglycaemia: Management in Birth Centre and Postnatal Ward algorithm.

Infants may be discharged from neonatal medical care and demand feed after 3 consecutive BSL ≥ 2.6 mmol/L.

Neonatal RMO to review infants daily until discharge from neonatal care.

Infants managed for hypoglycaemia in the postnatal ward do not require routine neonatal outpatient follow-up.

4.3 Management of infants with risk factors for, or diagnosis of hypoglycaemia in Newborn Intensive and Special Care

Measure **TBG** on blood gas analyser:

- Within one hour of arrival in NISC (or as ordered by neonatal RMO)
- If TBG ≥ 2.6 mmol/L repeat before next feed, or 3 hourly if infant nil orally
- If TBG < 2.6 mmol/L- repeat TBG in 1 hour
- Measure TBG **before** feeds if feed due

- Glucose monitoring may be discontinued when infant on full enteral feeds with 3 consecutive TBG readings ≥ 2.6 mmol/L
- Recommence glucose monitoring if indicated when change in feeding regime or clinical condition.

TBG ≥ 2.6 mmol/L:

- Feed by 1 hour of age (60mL/kg/day) with EBM if available, or formula
- Feed 3 hourly (if birthweight > 1.5kg)
- Complement breastfeeds with EBM/formula (30-60mL/kg/day)
- If there is any contraindication to enteral feeds - insert IV and commence 10% glucose infusion at 60mL/kg/day (4mg/kg/min).

TBG 1.5 - 2.5 mmol/L:

- Feed 2 hourly (60mL/kg/day)
- Commence feeding within 1 hour of admission with EBM if available, or formula
- If repeat TBG is 1.5-2.5 mmol/L increase feeds to 90ml/kg/day
- Change to 3 hourly feeds (if birthweight > 1.5kg) after 24 hours of age if at least 2 consecutive blood glucose readings ≥ 2.6mmol/L
- Complement breastfeeds with EBM/formula (60-90mL/kg/day)
- If there is any contraindication to enteral feeds - insert IV and commence 10% glucose infusion:
    - AGA infant - 70mL/kg/day (5mg/kg/min), increasing to 90mL/kg/day (6mg/kg/min) if subsequent TBG < 2.6 mmol/L
    - SGA infant - 90mL/kg/day (6mg/kg/min), increasing to 120mL/kg/day (8mg/kg/min) if subsequent TBG < 2.6 mmol/L.

TBG <1.5 mmol/L:

- For infants ≥ 34 weeks gestation:
    - Massage 0.5mL/kg of 40% glucose gel into buccal mucosa (nurse/midwife initiated) – refer to Neonatal Medicine Protocol
    - Consider an intramuscular injection of **glucagon** for infants ≥ 34 weeks gestation with adequate glycogen stores (birthweight > 10th centile) - refer to Neonatal Medicine Protocol. This will increase blood glucose whilst IV is inserted and 10% glucose infusion commenced.
- Insert IV and administer IV bolus of 2mL/kg 10% glucose (200mg/kg) over 3-5 minutes
- Commence 10% glucose infusion:
    - AGA infant - 70mL/kg/day (5mg/kg/min), increasing to 90mL/kg/day (6mg/kg/min) if subsequent TBG < 2.6 mmol/L
    - SGA infant - 90mL/kg/day (6mg/kg/min), increasing to 120mL/kg/day (8mg/kg/min) if subsequent TBG < 2.6 mmol/L.

TBG 1.5-2.5 mmol/L despite feeding regime:

- Consider an intramuscular injection of glucagon for infants ≥ 34 weeks gestation with adequate glycogen stores (birthweight > 10th centile) - refer to Neonatal Medicine Protocol. **The decision to insert an IV may be delayed until result of next TBG (repeated in 1 hour or as ordered by neonatal RMO).**

OR

- Insert IV and commence 10% glucose infusion at 90mL/kg/day (6mg/kg/min). (Do not administer IV bolus of 10% glucose if TBG ≥ 1.5mmol/L.

Refer to: appendix 2 for Management of Infants with Risk Factors for, or Diagnosis of, Hypoglycaemia algorithm.

Calculate and document IV glucose delivery rate in mg/kg/min (IV GDR = glucose concentration x TFI/144, or on-line glucose calculators: http://nicutools.org/MediCalcs/Glucose.php3 and http://www.adhb.govt.nz/newborn/Guidelines/Nutrition/GlucoseCalculator.html).

Continue enteral feeds as tolerated and support breastfeeding (do not make nil orally unless enteral feeding contraindicated).

Increase feeds gradually and gradually reduce IV glucose infusion when TBG readings are stable (at least 2 consecutive readings ≥ 2.6mmol/L).

Infants on 3 hourly sucking feeds may be discharged to postnatal ward as soon as BSL ≥ 2.6 mmol/L on 3 consecutive occasions. If hypoglycaemia has occurred, complementary feeds after breastfeeding may be necessary for a day or two until maternal breastmilk supply is established. Infants admitted to NISC for management of hypoglycaemia remain under neonatal care in postnatal ward for at least 72 hours.

Only infants admitted to NISC for management of hypoglycaemia who receive IV glucose for more than 3 days, and/or glucagon infusion, and/or diazoxide will be reviewed in the general neonatal outpatient clinic.

Persistent hypoglycaemia

Glucagon injection may be repeated once if initial response was good (TBG ≥ 2.6 mmol/L).

Increase rate of IV 10% glucose infusion (up to 150mL/kg/day - 10mg/kg/min)

- IV fluids must not be increased > 100mL/kg/day in the first 24 hours
- If fluid restriction necessary, increase glucose concentration.

Increase IV glucose concentration. **Concentrations above 12.5% must be given via a central venous line.** Refer to Neonatal Medicine Protocol. A glucose infusion rate >10mg/kg/min indicates hyperinsulinism.

If persistent hypoglycaemia in spite of increased glucose infusion rate/concentration, discuss with Paediatric Consultant and consider:

- Intravenous infusion of glucagon
- Administration of hydrocortisone.

Investigate for hyperinsulinism if hypoglycaemia persists after day 3 or if it is not possible to wean the glucose infusion.

Suspected hyperinsulinism

Diagnosis:

- macrosomia
- glucose infusion rate >10mg/kg/min
- hypoglycaemia persists after day 3.

Investigations: (Appendix 3)

When TBG < 2.0mmol/L collect arterial or venous blood for:

- glucose
- insulin
- growth hormone
- cortisol
- free fatty acids
- urine for ketones and organic acids.

Also consider:

- ammonia
- acyl-carnitine
- lactate.

Management:

- Aim for TBG > 3.0 mmol/L
- Consider ceasing enteral feeds (as may stimulate insulin release).
- Discuss specific management with Endocrinologist.

5. Evaluation, monitoring and reporting of compliance to this guideline

Compliance to this guideline will be monitored via clinical incidents reported through VHIMS.

6. References

1. Neonatal ehandbook, http://www.health.vic.gov.au/neonatalhandbook/
2. Hypoglycaemia http://www.health.vic.gov.au/neonatalhandbook/conditions/hypoglycaemia.htm
3. Diabetic Mother –Infant care http://www.health.vic.gov.au/neonatalhandbook/conditions/diabetic-mother-infant-care.htm
4. Cornblath M. et al, Controversies regarding definition of neonatal hypoglycemia: Suggested Operational Thresholds. Pediatrics 2000; 105:1141-45
5. Deshpande S, Ward Platt M. The investigation and management of neonatal hypoglycaemia. Seminars in Fetal & Neonatal Medicine 2005;10:351-361
6. Roberton's Textbook of Neonatology, Rennie JM (Ed), 2012, 5th edition
7. Williams A F. Neonatal hypoglycaemia: Clinical and legal aspects. Seminars in Fetal & Neonatal Medicine 2005;10:363-368
8. Harris DL, Weston PJ, Signal M, Chase G, Harding JE. Dextrose gel for neonatal hypoglycaemia (the Sugar Babies Study): a randomised, double-blind, placebo-controlled trial. Lancet 2013;382(9910):2077-83. Epub 2013 Sep 25
9. Marlow N. Treatment of blood glucose concentrations in newborn babies. Lancet. 2013 Dec 21;382(9910):2045-6. Epub 2013 Sep 25
10. Hawdon JM. Definition of neonatal hypoglycaemia: time for a rethink? Arch Dis Fetal Neonatal Ed 2013; 98(5):F382-3

7. Legislation/Regulations related to this guideline

Not licable.

8. Appendices

Appendix 1: Infants at Risk for Hypoglycaemia: Management in Birth Centre and Postnatal Ward

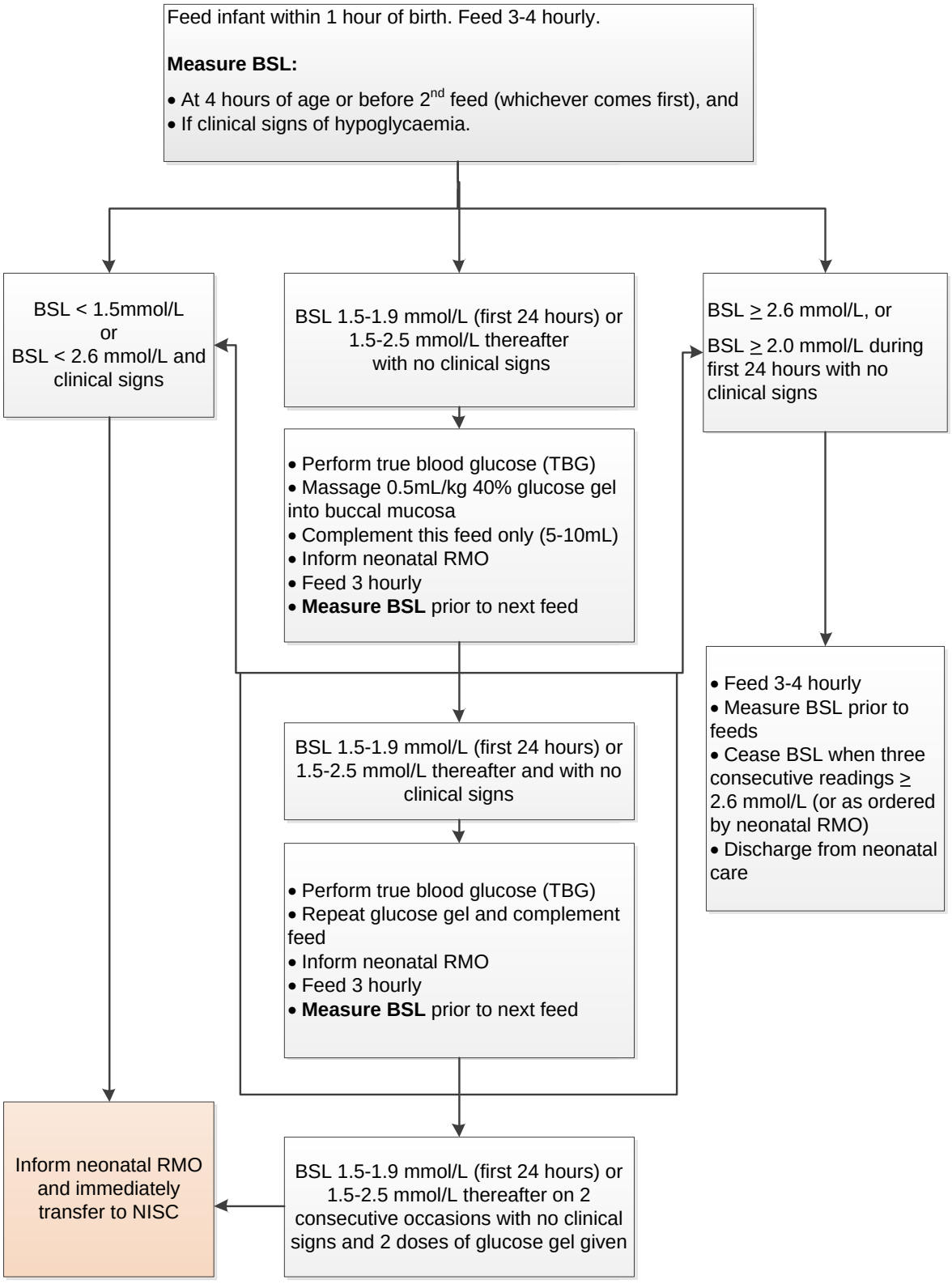
Appendix 2: Management of Infants admitted to NISC with Risk Factors for, or a Diagnosis of, Hypoglycaemia

Appendix 3: Hypoglycaemia screen

Hypoglycaemia - Infant Management

Appendix 1

Infants at Risk for Hypoglycaemia: Management in Birth Centre and Postnatal Ward

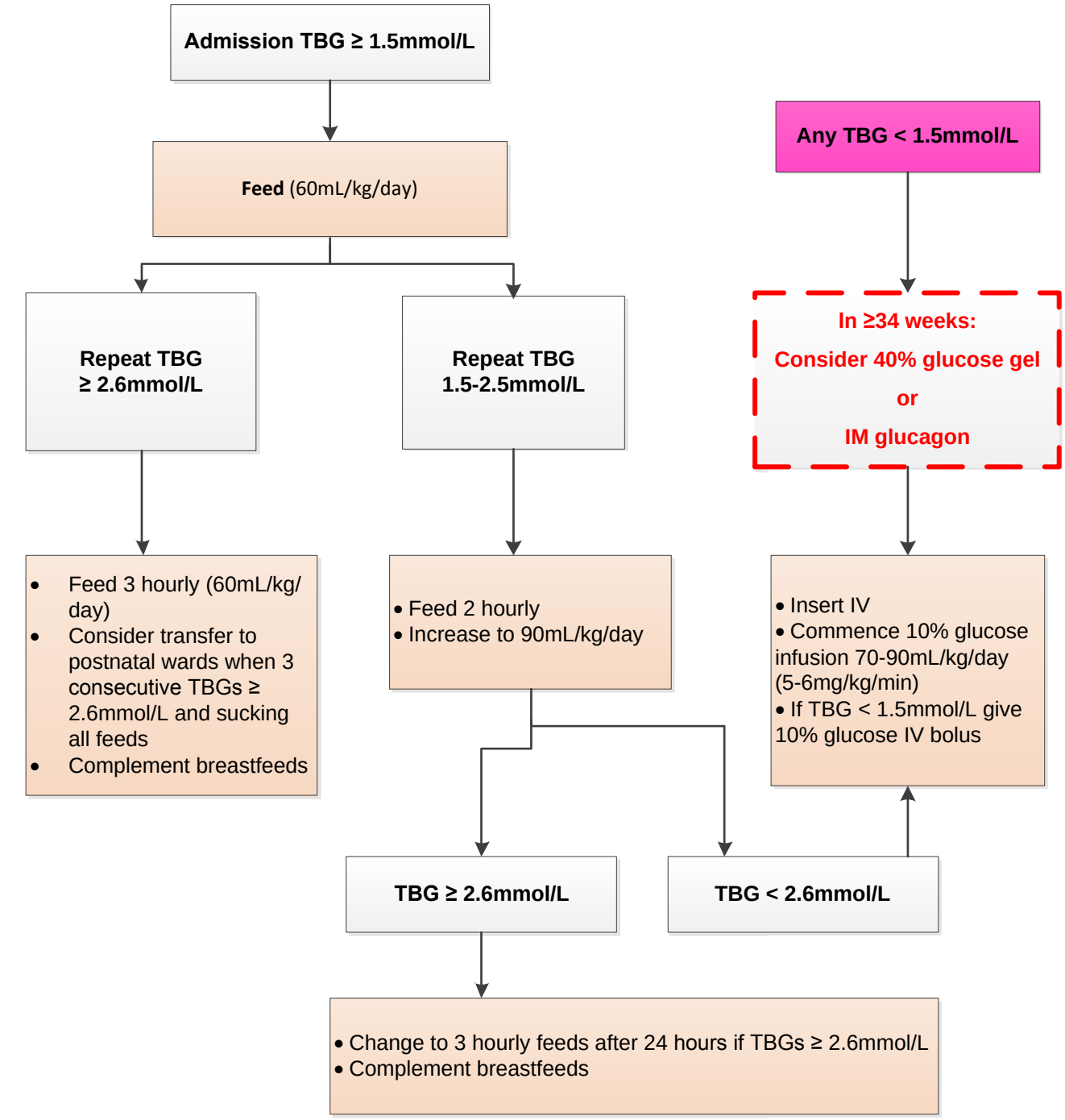


Notes:

- **Neonatal RMO may order up to 4 doses of 40% glucose gel (maximum 6 doses administered in first 48 hours after birth)**
- **Recommence glucose monitoring if change in feeding or clinical condition**

Appendix 2

Management of Infants admitted to NISC with Risk Factors for, or Diagnosis of, Hypoglycaemia

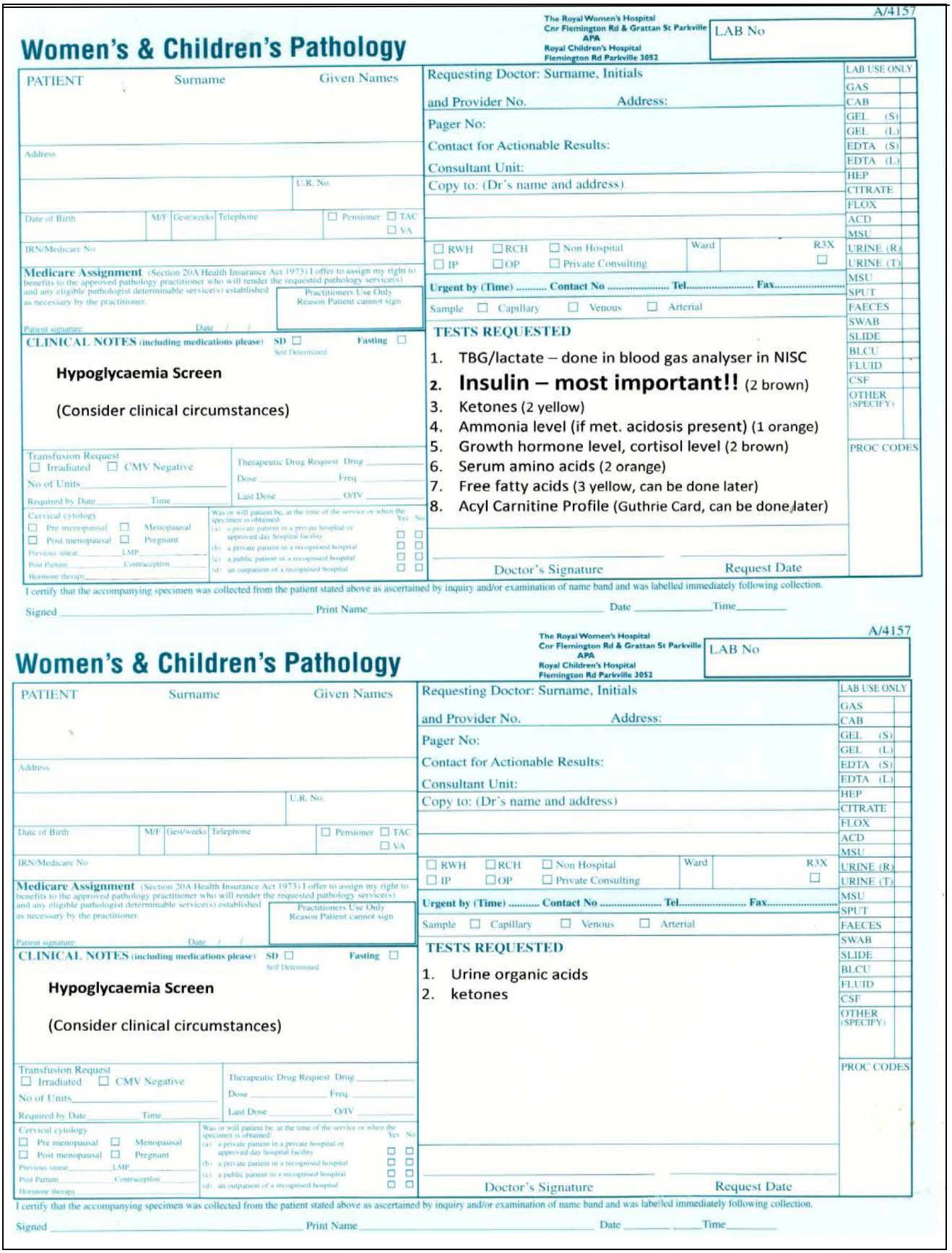


Notes:

- **If TBG ≥2.6mmol/L, repeat before next feed, or 3 hourly if infant nil orally**
- **If TBG <2.6mmol/L, repeat TBG or as ordered by neonatal RMO**
- **Measure TBG before feeds if feed due**
- **Glucose monitoring may be discontinued when 3 consecutive TBGs ≥2.6mmol/L and baby on full enteral feeds**
- **Recommence glucose monitoring if indicated when change in feeding regime or clinical condition**

Hypoglycaemia Screen

the women's
the royal women's hospital



A/4157

Women's & Children's Pathology

The Royal Women's Hospital
Cnr Flemington Rd & Grattan St Parkville
APA
Royal Children's Hospital
Flemington Rd Parkville 3052

LAB No

PATIENT Surname Given Names

Address

U.R. No.

Date of Birth | M/F | Gest/weeks | Telephone | ☐ Pensioner ☐ TAC ☐ VA

IRN/Medicare No

Medicare Assignment (Section 20A Health Insurance Act 1973) I offer to assign my right to benefits to the approved pathology practitioner who will render the requested pathology service(s) and any eligible pathologist determinable service(s) established as necessary by the practitioner.

Practitioners Use Only
Reason Patient cannot sign

Patient signature Date / /

CLINICAL NOTES (including medications please) SD ☐ Self Determined Fasting ☐

Hypoglycaemia Screen

(Consider clinical circumstances)

Transfusion Request
☐ Irradiated ☐ CMV Negative
No of Units
Required by Date Time

Therapeutic Drug Request Drug
Dose Freq
Last Dose O/IV

Cervical cytology
☐ Pre menopausal ☐ Menopausal
☐ Post menopausal ☐ Pregnant
Previous smear LMP
Post Partum Contraception
Hormone therapy

Was or will patient be, at the time of the service or when the specimen is obtained: Yes No
(a) a private patient in a private hospital or approved day hospital facility ☐ ☐
(b) a private patient in a recognised hospital ☐ ☐
(c) a public patient in a recognised hospital ☐ ☐
(d) an outpatient of a recognised hospital ☐ ☐

Requesting Doctor: Surname, Initials
and Provider No. Address:
Pager No:
Contact for Actionable Results:
Consultant Unit:
Copy to: (Dr's name and address)

☐ RWH ☐ RCH ☐ Non Hospital Ward R3X
☐ IP ☐ OP ☐ Private Consulting ☐

Urgent by (Time) ..... **Contact No** ..... **Tel**..... **Fax**.....

Sample ☐ Capillary ☐ Venous ☐ Arterial

TESTS REQUESTED

1. TBG/lactate – done in blood gas analyser in NISC
2. **Insulin – most important!!** (2 brown)
3. Ketones (2 yellow)
4. Ammonia level (if met. acidosis present) (1 orange)
5. Growth hormone level, cortisol level (2 brown)
6. Serum amino acids (2 orange)
7. Free fatty acids (3 yellow, can be done later)
8. Acyl Carnitine Profile (Guthrie Card, can be done later)

Doctor's Signature Request Date

LAB USE ONLY	
GAS	
CAB	
GEL (S)	
GEL (L)	
EDTA (S)	
EDTA (L)	
HEP	
CITRATE	
FLOX	
ACD	
MSU	
URINE (R)	
URINE (T)	
MSU	
SPUT	
FAECES	
SWAB	
SLIDE	
BLCU	
FLUID	
CSF	
OTHER (SPECIFY)	
PROC CODES	

I certify that the accompanying specimen was collected from the patient stated above as ascertained by inquiry and/or examination of name band and was labelled immediately following collection.

Signed Print Name Date Time

A/4157

Women's & Children's Pathology

The Royal Women's Hospital
Cnr Flemington Rd & Grattan St Parkville
APA
Royal Children's Hospital
Flemington Rd Parkville 3052

LAB No

PATIENT Surname Given Names

Address

U.R. No.

Date of Birth | M/F | Gest/weeks | Telephone | ☐ Pensioner ☐ TAC ☐ VA

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Hypoglycaemia Screen

(Consider clinical circumstances)

Transfusion Request
☐ Irradiated ☐ CMV Negative
No of Units
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Therapeutic Drug Request Drug
Dose Freq
Last Dose O/IV

Cervical cytology
☐ Pre menopausal ☐ Menopausal
☐ Post menopausal ☐ Pregnant
Previous smear LMP
Post Partum Contraception
Hormone therapy

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(a) a private patient in a private hospital or approved day hospital facility ☐ ☐
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Requesting Doctor: Surname, Initials
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Contact for Actionable Results:
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☐ RWH ☐ RCH ☐ Non Hospital Ward R3X
☐ IP ☐ OP ☐ Private Consulting ☐

Urgent by (Time) ..... **Contact No** ..... **Tel**..... **Fax**.....

Sample ☐ Capillary ☐ Venous ☐ Arterial

TESTS REQUESTED

1. Urine organic acids
2. ketones

Doctor's Signature Request Date

LAB USE ONLY	
GAS	
CAB	
GEL (S)	
GEL (L)	
EDTA (S)	
EDTA (L)	
HEP	
CITRATE	
FLOX	
ACD	
MSU	
URINE (R)	
URINE (T)	
MSU	
SPUT	
FAECES	
SWAB	
SLIDE	
BLCU	
FLUID	
CSF	
OTHER (SPECIFY)	
PROC CODES	

I certify that the accompanying specimen was collected from the patient stated above as ascertained by inquiry and/or examination of name band and was labelled immediately following collection.

Signed Print Name Date Time