Title:	Section:	Approved Date:
NEWBORN: HYPOGLYCEMIA IN NEONATES BORN AT 35+0 WEEKS GESTATION AND GREATER: DIAGNOSIS AND MANAGEMENT IN THE FIRST 72 HOURS	**WOMEN'S/CHILD HEALTH PROGRAMS NEWBORN: 80.275.750**	**October 2007**
Authorization Section Head, Neonatology, Program Director, Women's Health	**Revised Date:** **R1 21 Dec 2010** **R2 26 Jun 2012**	**Page** 1 of 5

1.0 PURPOSE:

1.1 To provide guidelines for the identification, monitoring and management of hypoglycemia for the first 72 hours of life in neonates born at 35 weeks gestational age or greater.

2.0 DEFINITIONS:

2.1 **Symptomatic Neonate:** Any neonate with a blood glucose level below 2.6 mmol/L and exhibiting any of the following:

- Jitteriness/tremulousness
- Apathy
- Episodes of cyanosis
- Convulsions
- Apnea or tachypnea
- Weak or high-pitched cry
- Limpness, lethargy
- Difficulty feeding
- Eye rolling
- Episodes of sweating, pallor, hypothermia
- Cardiac failure/arrest

2.2 **Sick/stressed neonate:** Neonates who are unwell or unable to be fed enterally including but not limited to those who:

- are septic or have signs of sepsis
- have respiratory distress with or without hypoxia
- have had significant perinatal depression or asphyxia
- have hypo or hyperthermia
- have significant congenital anomalies such as congenital heart disease
- are Rh iso-immunized

2.3 **"At Risk" Neonate:** Neonates who are at risk of developing hypoglycemia in the hours and days after birth as a result of risk factors including by not limited to:

- Premature neonates: Gestational age less than 37 weeks, 0 days
- Large for gestational age neonates (LGA): Birth weight greater than the 97th percentile on the Neonate Growth Chart
- Small for gestational age neonates (SGA): Birth weight less than the 3rd percentile on the Infant Growth Chart
- Neonates of diabetic mothers (IDM), regardless of type of diabetes or insulin usage
- Neonates at risk of having carnitine palmitoyl transferase-1 (CPT1) deficiency. See Newborn Guideline 80.275.361 Routine Screening in NICU and IMCN for a description of neonates.

2.4 **Neonate of a Diabetic Mother (IDM):** Neonates whose mothers have diabetes which may be Type 1, Type 2 or gestational diabetes.

2.5 **Glucose level:** Plasma or whole blood glucose level, measured in mmol/L regardless of method of measurement. Measured at the bedside using a point-of-care blood glucose meter.

2.6 **Intervention glucose level:** The glucose level below which active interventions to increase blood glucose levels are required.

2.7 **Target glucose level:** The goal blood glucose level above which interventions may be weaned as per protocol or glucose monitoring discontinued. The goal is to achieve this level by 6 hours of age.

2.8 **True blood sugar (TBS):** Venous/capillary/arterial blood sample sent to the laboratory (Refer to Diagnostic Services of Manitoba: Glucose – (P)).

2.9 **Glucose gel:** Dextrose in a gel form for buccal administration (Dex4 (39% carbohydrate) or Instaglucose (43% Dextrose); requires physician/neonatal nurse practitioner (NNP) order.

3.0 ALL NEONATES OF MOTHERS WITH TYPE 1 DIABETES:

3.1 Check blood glucose within 30 minutes after delivery.

3.2 If the neonate is not LGA, manage as per guidelines for "Asymptomatic neonates who are at risk" found in 5.0.

3.3 If neonate is LGA:
- 3.3.1 Establish peripheral IV and initiate intravenous (IV) D10W at a rate of 80 mL/kg/day (5.5 mg glucose/kg/min) on physician/NNP's order.
- 3.3.2 Admit neonate to IMCN or NICU. If baby is asymptomatic, bring the baby to the mother to breastfeed prior to transfer to IMCN as appropriate.
- 3.3.3 Check blood glucose 30 minutes after establishing or adjusting IV or after giving any fluid bolus.
- 3.3.4 Manage further care based on whether the neonate is symptomatic or asymptomatic as outlined in the appropriate following section.
- 3.3.5 Facilitate neonate feeding by breast or bottle as appropriate.
- 3.3.6 Care for neonate in IMCN/NICU for a minimum of 6 hours. Transfer to combined care only after there have been two consecutive glucose levels of 2.6 mmol/L or greater.

4.0 SYMPTOMATIC OR SICK/STRESSED NEONATES (*Regardless of risk factors*):

4.1 Check blood glucose as soon as symptoms or neonate illness or stress is recognized.

4.2 Glucose level 2.2 - 2.5 mmol/L AND neonate able to feed orally:
- 4.2.1 Send TBS.
- 4.2.2 Feed 5-10mL/kg expressed breast milk (EBM) or formula. If breastfeeding, consider feeding EBM through a method of supplementation and then allowing baby to feed ad lib at the breast.
- 4.2.3 Check blood glucose level one hour after start of feeding. If glucose level is greater than 2.5 mmol/L following the weaning guideline in 5.0.

4.3 Glucose level 2.2-2.5 mmol/L in an neonate unable to feed or be fed enterally OR any level less than 2.2 mmol/L:
- 4.3.1 Send TBS and notify physician.
- 4.3.2 Establish peripheral IV and initiate intravenous (IV) D10W at a rate of 80 - 100 mL/kg/day (5.5 mg glucose/kg/min) on physician/NNP order.
- 4.3.3 Give bolus of 2 mL/kg of D10W on physician/NNP order if neonate symptomatic.
- 4.3.4 Check blood glucose level 30 minutes after IV initiated.

4.4 Transfer to either IMCN/Triage or NICU and maintain there until:
- 4.4.1 Symptoms resolve and they have two glucose levels greater than 2.2 mmol/L
- 4.4.2 Mild symptoms persist and two glucose levels 2.6 mmol/L or greater.
- 4.4.3 Over 6 hours of age and two glucose levels 2.6 mmol/L.

4.5 Physician/NNP assesses the neonate before transfer to combined care with mother. Follow ongoing and weaning of monitoring and IV as per guidelines in 6.0.

5.0 ASYMPTOMATIC NEONATES WITH RISK FACTORS FOR HYPOGLYCEMIA:

(For algorithm see Appendix A)

5.1 Facilitate neonate feeding by breast or 5-10 mL/kg of formula before the first blood glucose measurement.

5.2 For IDM (non-Type 1) who are LGA, or if the mother required insulin during pregnancy, perform a glucose test with a bedside glucose meter within 60 minutes after delivery.

5.3 For all other "at risk" neonates perform a glucose test with a bedside glucose meter within 2 hours after delivery.

5.4 Glucose level less than 1.8 mmol/L:
- 5.4.1 Repeat glucose test at bedside, send TBS and notify physician/NNP.
- 5.4.2 Establish peripheral IV and initiate intravenous (IV) D10W at a rate of 80 - 100 mL/kg/day (5.5 mg glucose/kg/min) on physician/NNP's order.
- 5.4.3 Consider bolus of 2 mL/kg of D10W on physician/NNP order.
- 5.4.4 Check blood glucose level 30 minutes after IV initiated.
- 5.4.5 Nurse and physician/NNP determine the feeding and care plan based on the neonate's condition. Transfer to IMCN/Triage or NICU. See 5.8 for eligibility for transfer back to combined care.

5.5 Glucose level 1.8 - 2.1 mmol/L:
- 5.5.1 Consider glucose gel 0.5mL/kg. Physician/NNP order required for glucose gel. Feed neonate. If mother is breastfeeding and neonate did not receive glucose gel then supplement neonate with 5mL/kg of EBM or formula.
- 5.5.2 Check blood glucose one hour after start of feed. Determine next steps based on result.
- 5.5.3 Neonates not meeting the criteria in 5.8.1 prior to the transfer of the mother to Family Centred Mother Baby Unit (FCMBU) should be transferred to IMCN/triage.

5.6 Glucose level 2.2 mmol/L and higher:
- 5.6.1 Breast or bottle feeding every 2-3 hours on demand. Smaller frequent feeds rather than larger less frequent feeds.
- 5.6.2 Supplement breastfed neonates with 5mL/kg of EBM or formula, or glucose gel (with physician/NNP's order, maximum of 2 doses total) until checked glucose level is at least 2.6 mmol/L before each feed.
- 5.6.3 Glucose levels 2.2 mmol/L and higher do not need to be rechecked after feeds.

5.7 Consult physician/NNP for persistent glucose levels less than 2.2 mmol/L before 6 hours of age or less than 2.6 mmol/L after 6 hours of age.

5.8 Neonates should be cared for in IMCN/Triage or NICU until:
- 5.8.1 They have two glucose levels 2.2 mmol/L or greater if less than 6 hours of age
- 5.8.2 They have two glucose levels 2.6 mmol/L or greater if greater than 6 hours of age

6.0 GLUCOSE WEANING, MONITORING AND THERAPY FOR ALL NEONATES:

6.1 If IDM, check glucose every hour until 3 hours of age, then approximately every 3 hours prior to feeds for 24 hours. Consult physician/NNP if glucose level less than 2.2 mmol/L prior to 6 hours of age OR less than 2.6 mmol/L after 6 hours of age.

6.2 All other "at risk" neonates require a check of next glucose at 3 hours of age and then approximately every 3 hours prior to feeds.

6.3 Discontinue glucose checks when glucose is at least 2.6 mmol/L on two consecutive glucose checks AND neonate is:
- 6.3.1 LGA and not IDM, or neonate is at risk for CPT-1 deficiency: 12 hours of age.
- 6.3.2 IDM: 24 hours of age.
- 6.3.3 Less than 37 weeks gestation or SGA: 36 hours of age.

6.4 Neonates cared for in IMCN/Triage or NICU may be transferred to combined care with appropriate IV weaning orders (if IV established) when:
- 6.4.1 Less than 6 hours of age - two glucose levels of 2.2 mmol/L or higher.
- 6.4.2 Over 6 hours of age – two glucose levels of 2.6 mmol/L or higher.

6.5 Begin weaning IV by 20% of the initial full rate when there are 3 consecutive blood glucose levels of 2.6 mmol/L or greater. Maintain that rate until the next feeding. Check blood glucose prior to next feeding and wean based on the glucose level:
- 6.5.1 2.6 mmol/L or greater – decrease IV rate by 20% of initial full rate.
- 6.5.2 2.2 - 2.5 mmol/L and neonate asymptomatic– feed and keep IV at same rate. Notify physician/NNP if this occurs at two consecutive feeds.
- 6.5.3 Less than 2.2 mmol/L OR neonate symptomatic, notify physician/NNP.

6.6 Wean IV at 20% each decrease until rate is 2 mL/hr then saline lock or discontinue IV.

6.7 Consult Pediatric Metabolic Service for all neonates at risk for CPT-1 deficiency with documented glucose less than 2.2 mmol/L.

7.0 REFERENCES:

7.1 Duvanel, C. B, Fawer, C. L., Cotting, J., Hohlfeld, P., & Matthieu, J. M. (1999) Long-term effects of neonatal hypoglycemia on brain growth and psychomotor development in small-for-gestational-age preterm infants. *Journal of Pediatrics, 134*:492-8. (still current)

7.2 Fetus and Newborn Committee, Canadian Pediatric Society (2004). Screening guidelines for newborns at risk for low blood glucose. *Pediatrics & Child Health*; *9*(10): 723-729.

7.3 Harris, D. L., Weston, P. J., Battin, M. R., & Harding, J. E. (2011). Randomised Trial of Dextrose Gel for Treating Neonatal Hypoglycaemia: the Sugar Babies Study. *Pediatric Research*, *70*(5), 5550. Retrieved from http://journals.lww.com/pedresearch/Fulltext/2011/11001/Randomised_Trial_of_Dextrose_Gel_for_Treating.652.aspx

7.4 Kramer, N.S., Platt R.W., Wen S. W. et al. (2001). A new and improved population-based Canadian reference for birth weight for gestational age. *Pediatrics*,*108*(20:E35) (still current)

8.0 RESOURCES:

8.1 Medical Director, Neonatology, St. Boniface General Hospital
8.2 Metabolic Service, Genetics & Metabolism Department, Child Health
8.3 Neonatologist/Assistant Medical Director IMCN (2010 revision)
8.4 Neonatologist, Women's Hospital, HSC
8.5 Nurse Educator, Women's Health Program, HSC

Appendix 1: Management of Well, Asymptomatic Neonates Born at 35+0 Weeks GA or greater At Risk for Hypoglycemia

Guideline only – individual patient assessment is required. Algorithm must be used with accompanying guideline