

 <p>NEONATAL CLINICAL PRACTICE GUIDELINE</p>	Title: Hypoglycemia in Newborns	
	Approval Date: March 2016, Last Revised July 2018	Pages: 1 of 11
	Approved by: Neonatal Patient Care Teams, HSC & SBH Women's Health Maternal Newborn Committee Child Health Standards Committee	Supersedes: HSC# 80.275.750

1.0 PURPOSE AND INTENT

- 1.1 To provide guidelines for identification, monitoring and management of hypoglycemia in newborns within the WRHA. See algorithm in Appendix A.

Note: All recommendations are approximate guidelines only and practitioners must take in to account individual patient characteristics and situation. Concerns regarding appropriate treatment must be discussed with the attending care provider.

2.0 PRACTICE OUTCOME

- 2.1 To prevent the complications of severe or persistent hypoglycemia including brain injury resulting in developmental delay, learning disabilities, heart failure or seizures.

3.0 DEFINITIONS AND ABBREVIATIONS

- 3.1 **Blood Glucose level:** Measurement of glucose in plasma or whole blood in mmol/L regardless of method of measurement. For purposes of this document, glucometer glucose refers to point of care monitoring. TBS refers to True Blood Sugar, a venous or capillary sample analyzed in the chemistry lab.
- 3.2 **Infant of a Diabetic Mother (IDM):** Infant or neonate born to a mother with Type 1, Type 2 or gestational diabetes with or without insulin treatment.
- 3.3 **Glucose gel:** Dextrose in the form of gel, approximately 40% carbohydrate, for buccal administration. This does not require a care provider order and can be given by a nurse using the criteria outlined in this guideline. Dose is 0.5 mL/kg. See instructions for preparation and administration in Appendix B.
- 3.4 **Care Provider:** A physician, nurse practitioner, clinical assistant/physician assistant or midwife with prescriber responsibility in the care of the newborn.

4.0 GUIDELINES

- 4.1 Identify all babies who are “at risk” for development of hypoglycemia based on any of the following criteria:
- Born at less than 37 weeks gestation
 - Large for gestational age (LGA) with birth weight greater than the 90th percentile on the infant growth chart
 - Small for gestational age (SGA) with birth weight less than the 10th percentile on the infant growth chart.
 - Infant of diabetic mother (IDM)
 - Infants at risk of having carnitine palmitoyl transferase-1 (CPT-1) deficiency, including those with known family history and all neonates of Inuit families.

Note: For Out of Hospital Births see Appendix E for clinical practice guideline for midwifery.

4.2 Assess **all** newborns for symptoms of hypoglycemia (immediately and ongoing):

Mild Symptoms:	Severe Symptoms:
<ul style="list-style-type: none"> • Jitteriness or tremulousness • Limpness, mild lethargy • Difficulty feeding • Eye rolling • Weak or high-pitched cry 	<ul style="list-style-type: none"> • Apnea or tachypnea • Seizures • Cyanosis • Cardiac failure / arrest • Episodes of sweating • Pallor • Hypothermia

4.3 Check glucometer glucose immediately if any of the symptoms are present. Determine next steps based on the result, as outlined below and on the algorithm found in Appendix A.

4.4 For all “at risk” babies as identified above, who are ≥ 35 weeks gestation at birth, facilitate skin to skin care with mother and feeding by breast or 5-10 mL/kg of formula or expressed breast milk. Check glucometer glucose at approximately 2 hours after birth, after the first feed. Determine the next steps based on the result and assessment of the baby for symptoms of hypoglycemia as outlined in 4.2.

4.5 For **asymptomatic infants** glucometer glucose ≥ 2.6 mmol/L

4.5.1 Check glucometer glucose every 3-6 hours prior to feeds. Continue until 2 consecutive measurements are ≥ 2.6 mmol/L AND for the specified time frame outlined below:

- 12 hours of age if IDM or LGA or those at risk for CPT-1 deficiency.
- 36 hours of age if SGA or < 37 weeks gestation AND feeding established.

4.6 For **symptomatic infants** with glucometer glucose ≥ 2.6 mmol/L call care provider to assess for alternate causes of symptoms.

4.7 For **infants with mild or no symptoms**: Glucometer glucose **1.8-2.5 mmol/L** and infant is ≥ 35 weeks gestation:

4.7.1 Give glucose gel 0.5 mL/kg AND,

4.7.2 Feed baby by breast or 5-10 mL/kg bottle formula or expressed breast milk.

4.7.3 Repeat glucometer glucose 1 hour after feed,

4.7.4 If glucometer glucose remains between 1.8-2.5 mmol/L repeat glucose gel, feed and repeat glucometer glucose 1 hour later.

If glucometer glucose ≥ 2.6 mmol/L, follow continued monitoring outlined in 4.5.

4.7.5 If glucometer glucose remains < 2.6 mmol/L after 2 doses of glucose gel, call care provider (in house) to order IV glucose maintenance and send TBS.

4.7.6 If glucometer glucose < 1.8 mmol/L follow steps in 4.8.

4.7.7 Consider transfer to neonatal unit or neonatology consult for persistent hypoglycemia.

4.8 For **infants with severe symptoms** (as outlined in 4.2) with glucometer glucose 1.8-2.5 mmol/L and neonate is ≥ 35 weeks gestation **or for ANY glucometer glucose result < 1.8 mmol/L** regardless of symptoms:

4.8.1 **Call Neonatology on call person immediately.**

4.8.2 **If symptomatic proceed to IV immediately as outlined in 4.8.4**

4.8.3 If glucose < 1.8 without symptoms: give glucose gel 0.5 ml/kg. Feed baby. Repeat glucometer glucose 30 min after the glucose gel and call Neonatology with result.

4.8.4 Consider IV D10W at 80 mL/kg/24 hours and IV bolus D10W 2 mL/kg.

4.8.5 Repeat glucometer glucose 30 minutes after IV bolus and determine next steps with Neonatology based on result.

- 4.9 **IV weaning:** Following 2 or 3 consecutive blood glucose levels of 2.6 mmol/L or greater, decrease IV by 10 to 20% of the initial full rate, following the feed. Maintain that rate until the next feeding. Check blood glucose prior to next feed and wean IV based on the glucose level:
- 4.9.1 2.6 mmol/L or greater – decrease IV by 20%
 - 4.9.2 2.2-2.5 mmol/L and asymptomatic infant – feed and keep IV at same rate. Notify care provider if this occurs at two consecutive feeds
 - 4.9.3 Wean IV by 20% each decrease until rate is 2 mL/hr then saline lock or discontinue IV.
 - 4.9.4 Check blood glucose prior to the next feed after the discontinuation of IV dextrose.
- 4.10 After consultation with care provider and clinical judgment dictates variation from guideline, care provider documents in the progress notes.
- 4.11 For infants **<35 weeks** gestation: Glucometer glucose **<2.6 mmol/L**– Call care provider. Glucose gel is not recommended for use in this age group.
- 4.12 Infants cared for in a neonatal unit with hypoglycemia requiring IV treatment:
- 4.12.1 Continue to monitor glucometer glucose prior to feeds.
 - 4.12.2 Maintain care in the neonatal unit until glucometer glucose is ≥ 2.6 mmol/L on at least two consecutive glucometer glucose checks at least 3 hours apart, and infant showing no symptoms of hypoglycemia after 6 hours of age.
 - 4.12.3 Care provider assesses the baby before transfer to mother/baby unit and notifies the receiving care provider of transfer. Continue to monitor blood glucose according to risk categories outlined in 4.5. Initiate weaning IV before transfer out of NICU. If the decision is made to begin weaning the IV in the mother-baby area this must be approved by the care provider and the unit involved before transfer.
- 4.13 For infants > 72 hours of age **with no known etiology for hypoglycemia** : Blood glucose < 2.6 mmol/L measured before one feed, OR <3.3 mmol/L before two consecutive feeds by glucometer glucose, OR one lab true blood glucose <3.3 mmol/L - **after a complete assessment**.
- 4.13.1 Send the following prefeeding bloodwork to Clinical Chemistry: TBS, Beta-Hydroxybutyrate, Cortisol, Insulin and Growth Hormone. Draw a central sample to decrease the chance of hemolysis of the sample and misleading blood glucose results.
 - 4.13.2 Call Respiratory Therapist to do a blood gas with lactate. If results show metabolic acidosis or high lactate (>4.0 or base deficit >-10) with no known etiology – confirm with an arterial gas and if persistent consult Pediatric Metabolic Service.
 - 4.13.3 If a metabolic or endocrine cause is suspected from results of the blood glucose consult either Metabolic or Pediatric Endocrinology services for assistance with acute and/or chronic management.
 - 4.13.4 If infant of Inuit descent consult Pediatric Metabolic Service for investigation of CPT-1 deficiency.
See Appendix C for decision-making checklist.
- 4.14 After diazoxide is started, consider a targeted echocardiogram if the neonate's respiratory status worsens and needs increased oxygen or respiratory support or if there is evidence of fluid overload. (see guideline [Integrated Evaluation of Neonatal Hemodynamics and Targeted Echocardiogram](#)).
- 4.15 For neonates with a confirmed endocrine or metabolic cause for hypoglycemia:
- 4.15.1 Conduct a 5-6 hour fast prior to discharge in consultation with Pediatric Endocrinologist
 - 4.15.2 Utilize the appropriate discharge checklist as found in Appendix D.
- 4.16 For infants <35 weeks and those who are ill and admitted to a neonatal unit, check glucometer glucose on admission. Discuss with caregiver in order to adjust IV fluids according to the results. Do subsequent tests based on clinical assessment.
- 4.17 Infants receiving total parenteral nutrition (TPN), check glucometer glucose after initiation of TPN and after any changes in glucose dose infused or deterioration in clinical status monitor q8h x 24 hours. Discontinue after 2 consecutive values >2.6 mmol/L measured pre-feed.

5.0 PRIMARY AUTHORS

- 5.1 Dr. Ruben Alvaro, Neonatologist, Medical Director, NICU St. Boniface Hospital
- 5.2 Dr. Fabiana Postolow, Neonatologist, Assistant Medical Director, IMCN, Health Sciences Centre
- 5.3 Doris Sawatzky-Dickson, Clinical Nurse Specialist, NICU, Health Sciences Centre
- 5.4 Tanya Tichon, Nurse Educator, NICU, Health Sciences Centre
- 5.5 Shauna Mason, Nurse Educator, Women's Health, Health Sciences Centre
- 5.6 Laurie Bobula, Nurse Educator, Women's Health, St. Boniface Hospital

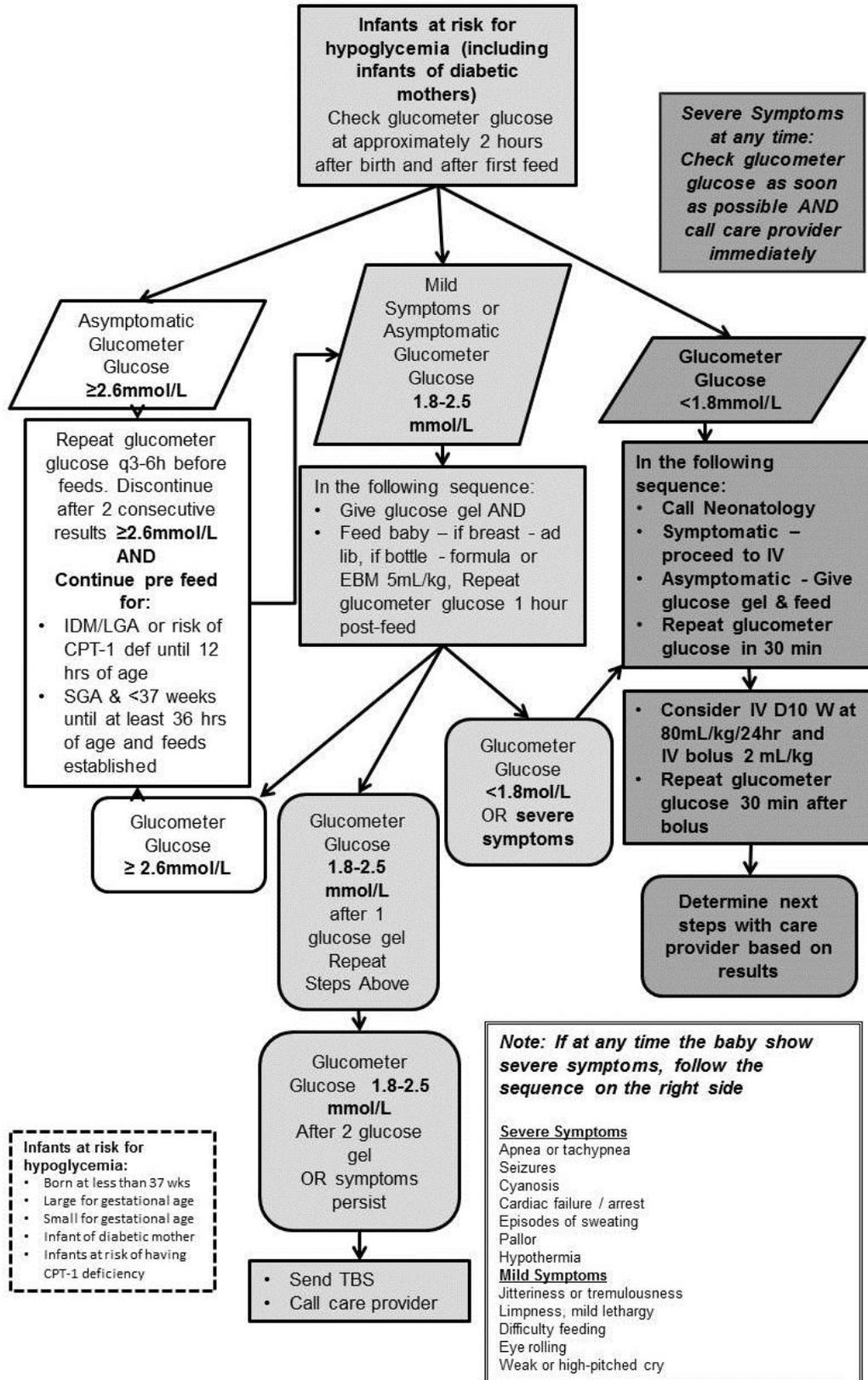
6.0 REFERENCES

- 6.1 Adamkin, D.H. (2016). Neonatal hypoglycemia. *Pediatrics*, 28(00), 1-6.
- 6.2 Canadian Pediatric Society (2004, reaffirmed 2016). Screening guidelines for newborns at risk for low blood glucose. *Paediatrics and Child Health*, 9(10), 723-729.
- 6.3 Harris, D.L., Alsweiler, J.M., Ansell, J.M., Gamble, G.D., Thompson, B., Woules, T.A., Yu, T.Y., & Harding, J.E., CHYLD Study Team (2015). Outcome at 2 years after dextrose gel treatment for neonatal hypoglycemia: Follow-Up of a randomized trial. *The Journal of Pediatrics*, online before press.
- 6.4 McKinlay, C.J.D., Alsweiler, J.M., Ansell, J.M., Anstice, N.S., Chase, J.G., Gamble, G.D., Harris, D.L., Jacobs, R.J., Jiang, Y., Paudel, N., Signal, M., Thompson, B., Woules, R.A., Yu, R.Y., & Harding, J.E., for the CHYLD Study Group. (2015). Neonatal glycemia and neurodevelopmental outcomes at 2 years. *New England Journal of Medicine*, 373(16), 1507-1518.
- 6.5 Thornton, P.S., Stanley, C.A., De Leon, D.D., Harris, D., Haymond, M.W., Hussain, K., Levitsky, L.L., Murad, M.H., Rozance, P.J., Simmons, R.A., Sperling, M.A., Weinstein, D.A., White, N.H., & Wolfsdorf, J.I. (2015). Recommendations from the Pediatric Endocrine Society for evaluation and management of persistent hypoglycemia in neonates, infants and children. *The Journal of Pediatrics*, 167(2), 238-245.
- 6.6 Weston, P.J., Harris, D.L., Battin, M., Brown, J., Hegarty, J.E. & Harding, J.E. (2016). Oral dextrose gel for the treatment of hypoglycaemia in newborn infants. *Cochrane Database of Systematic Reviews*, Issue 5.

Appendix A

Algorithm

Hypoglycemia Screening and Management in Newborns ≥ 35 wks



Appendix B

Instructions for Glucose Oral Gel Preparation and Administration

Materials Required:

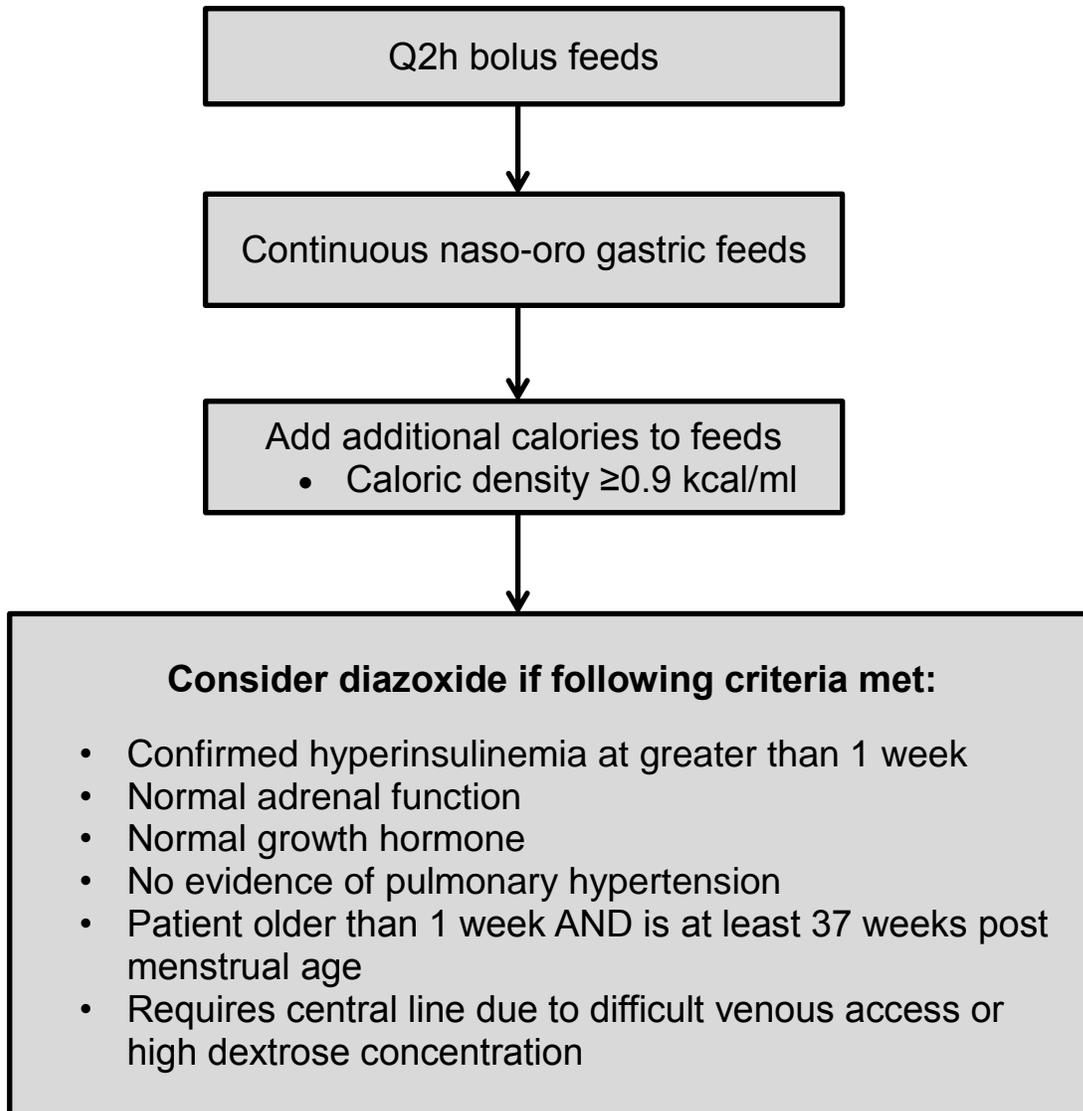
Glucose Oral Gel (Instaglucoose or Dex 4 Gel) - 1 tube Oral Syringe 5 mL size with cap – 1

Preparation:

1. Remove the plunger from the oral syringe.
2. Place the cap on the tip of the syringe.
3. Open the tube of glucose gel.
4. Squirt the glucose gel into the capped syringe until the desired volume is reached. Dose is 0.5 mL/kg
5. Replace the plunger back in the syringe until it is just secure. Do not push too hard as there will be air under pressure as well as glucose gel in the syringe.
6. Invert the syringe so that the cap is on top.
7. Remove the cap. Push up on the plunger to remove any air from the syringe.
8. Make a final adjustment of the volume and double check the dose.
9. Replace the tube into the clear container it is dispensed in, or another clean receptacle. It may be used for required doses for up to 24 hours kept at room temperature.

Appendix C

Decision-Making for Infants 72 Hours of Age with Persistent Hypoglycemia



Appendix D

Discharge Checklist for Infants with Hypoglycemia and Hyperinsulinemia

CHECK BOXES AND INITIAL WHEN COMPLETED	Initials
<p>Parent or Caregiver Teaching:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Met with the Endocrinology Nurse or physician to discuss diagnosis <input type="checkbox"/> Use of glucometer <input type="checkbox"/> Target range of blood glucoses _____ mmol/L to _____ mmol/L <input type="checkbox"/> At home treatment of hypoglycemia (low blood glucose < 3.2 mmol/L) <input type="checkbox"/> Medication teaching (see below) <input type="checkbox"/> Repeat echocardiography (TNE or by Cardiology) <input type="checkbox"/> Teaching regarding symptoms of pulmonary hypertension <input type="checkbox"/> To contact Pediatric Endocrinology if the blood glucoses are frequently too low (<3.2 mmol/L) or too high (>6.0mmol/L) <p>Pediatric Endocrinology nurse: Monday to Friday 8:00am - 4:00 pm at 204-787-2490 Pediatric Endocrinologist physician on call: 24 hour on call at 204-787-2071</p>	
<p>Medication:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Diazoxide <ul style="list-style-type: none"> <input type="checkbox"/> Dose of Diazoxide _____ mg every 8 hours = _____ ml every 8 hours by mouth <input type="checkbox"/> Caregiver(s) has been instructed on how to give this medication, by _____ <input type="checkbox"/> Pediatric Endocrinologist has sent prescription to Pharmacy _____ (standard concentration for Diazoxide will be 10 mg/mL) <p>OR</p> <ul style="list-style-type: none"> <input type="checkbox"/> Octreotide <ul style="list-style-type: none"> <input type="checkbox"/> Dose of Octreotide is _____ micrograms every _____ hours subcutaneously <input type="checkbox"/> Pediatric Endocrinologist has provided prescription to Pharmacy _____ <p>(concentration of Octreotide prescribed is _____ mcg / _____)</p> <p>Dose = _____ units on a syringe- given every _____ hours</p> <ul style="list-style-type: none"> <input type="checkbox"/> Caregiver(s) has been instructed how to give his medication, by _____ 	
<ul style="list-style-type: none"> <input type="checkbox"/> Glucagon (optional) <ul style="list-style-type: none"> <input type="checkbox"/> Caregiver(s) has been instructed how to give intramuscular glucagon in case of emergency by _____ Dose _____ mg IM 	
<ul style="list-style-type: none"> <input type="checkbox"/> IM Hydrocortisone (optional) <ul style="list-style-type: none"> Caregiver(s) has been instructed how to give intramuscular hydrocortisone in case of emergency by _____ Dose _____ mg IM 	
<p>Infant's Clinical Status:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Infant must be able to maintain a blood glucose of at least 3.3 mmol/L pre feeds <input type="checkbox"/> The infant should be fasted in the NICU prior to discharge and be able to maintain this target blood glucose after a minimum of 4 h (ideally 5 or 6 hours) After _____ hours - _____ mmol/L - date _____ 	
<ul style="list-style-type: none"> <input type="checkbox"/> Caregiver has all medications checked off above, in hand prior to discharge <input type="checkbox"/> Clinic Follow up Appointment with Pediatric Endocrinology Booked: <input type="checkbox"/> Clinic Follow up Appointment with Pediatric Cardiology Booked: Cardiology Date _____ Time _____ Endocrinology Date _____ Time _____ 	<input type="checkbox"/>

Discharge Checklist for Infants with Hypoglycemia and Hypopituitarism

CHECK BOXES AND INITIAL WHEN COMPLETED	Initials
<p>Parent or Caregiver Teaching:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Met with the Endocrinology Nurse or physician to discuss diagnosis <input type="checkbox"/> Use of glucometer <input type="checkbox"/> Target range of blood glucoses ____ mmol/L to ____ mmol/L <input type="checkbox"/> At home treatment of hypoglycemia (low blood glucose < 3.2 mmol/L) <input type="checkbox"/> Medication teaching (see below) <input type="checkbox"/> To contact Pediatric Endocrinology if the blood glucoses are frequently too low (<3.2 mmol/L) or high (>6.0mmol/L) <p>Pediatric Endocrinology nurse: Monday to Friday 8:00am - 4:00 pm at 204-787-2490 Pediatric Endocrinologist physician on call: 24 hour on call at 204-787-2071</p>	
<p>Medication:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Prednisolone (Glucocorticoid) <ul style="list-style-type: none"> <input type="checkbox"/> Dose of Prednisolone is ____ mg = ____ ml ____ times a day by mouth <input type="checkbox"/> Caregiver(s) has been instructed how to give this medication by _____ <input type="checkbox"/> Illness management reviewed - dose will be doubled in case of illness or fever <input type="checkbox"/> Illness Management Plan Letter provided <input type="checkbox"/> Teaching and prescriptions for other pituitary replacement hormones if applicable (growth hormone and/or L-thyroxine and/or DDAVP) (circle if applicable) <input type="checkbox"/> Pediatric Endocrinologist has provided prescription to Pharmacy _____ <p>(standard concentration for Prednisolone will be 1mg/ml)</p> <p>OR</p> <ul style="list-style-type: none"> <input type="checkbox"/> Growth hormone <ul style="list-style-type: none"> <input type="checkbox"/> Dose of growth hormone is ____ mg/ day 7 days per week <input type="checkbox"/> Caregiver(s) has been instructed how to give this medication by _____ <input type="checkbox"/> How to prepare _____ <input type="checkbox"/> Pediatric Endocrinology has sent the prescription to NIFB; GH was approved _____(date) 	
<ul style="list-style-type: none"> <input type="checkbox"/> Glucagon (optional) <ul style="list-style-type: none"> <input type="checkbox"/> Caregiver(s) has been instructed how to give intramuscular glucagon in case of emergency by _____ Dose _____ mg IM 	
<ul style="list-style-type: none"> <input type="checkbox"/> IM Hydrocortisone (optional) Caregiver(s) has been instructed how to give intramuscular hydrocortisone in case of emergency by _____ Dose _____ mg IM 	
<p>Infant's Clinical Status:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Infant must be able to maintain a blood glucose of at least 3.3 mmol/L pre feeds <input type="checkbox"/> The infant should be fasted in the NICU prior to discharge and be able to maintain this target blood glucose after a minimum of 4 h (ideally 5 or 6 hours) After _____ hours - _____ mmol/L - date _____ 	
<p>Discharge Preparation:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Caregiver has all medications checked off above, in hand prior to discharge <input type="checkbox"/> Clinic Follow up Appointment with Pediatric Endocrinology Booked: <p>Date _____ Time _____</p>	

Appendix E

 MIDWIFERY CLINICAL PRACTICE GUIDELINE	Title: Newborn Hypoglycemia Screening and Management at Out-of-hospital births	Policy Number: MWP3-3
	Approval Date: APRIL 6, 2017.	Pages: 1
	Approved by: ENSIEH TAEIDI, Clinical Director of Midwifery Services	Supercedes: NEW

PURPOSE

1. To contextualize the “WRHA Neonatal Clinical Practice Guideline: Hypoglycemia in Newborns (March 2016)” for use by midwives in out-of-hospital settings.

GUIDELINE

1. Midwives follow the WRHA Clinical Practice Guideline for Hypoglycemia in Newborns (CPG).
2. Facilitate a prenatal informed choice discussion regarding out-of-hospital births and regional guidelines for neonatal hypoglycemia screening during prenatal place of birth discussions.
3. Anytime a newborn presents with symptoms of hypoglycemia, take a glucometer glucose reading.
4. If the newborn has a low glucometer glucose reading ($\leq 2.6\text{mmol}$), give glucose gel and transport to the hospital.
 - a. If a newborn is less than 2 hours of age and is symptomatic of hypoglycemia transport the newborn to hospital by ambulance. When a transport is indicated, the midwife will call the on-call neonatologist to consult and determine to which hospital the newborn should be transferred.
5. Identify all newborns “at risk” for hypoglycemia based on the CPG and take a glucometer glucose reading at 2 hours of age.
6. Follow the CPG for timing of screening and application of the glucose gel as required.
7. If the algorithm for screening will take $>6\text{hrs}$, review the CPG with the parents and recommend transport to hospital to complete the algorithm for care of the “at risk” newborn.
8. For the “at risk” newborn: If there are two normal consecutive readings ($\geq 2.6\text{mmol}$) within 6 hours facilitate an informed choice discussion with the parent(s) about the CPG and OOH plan of care; offer transfer to hospital to continue the CPG algorithm or stay at home/discharge home.
9. For parent(s) who choose discharge from the birth centre at 6 hours postpartum or to stay at home after a homebirth:
 - a. Review symptoms of hypoglycemia and normal wake/sleep/feeding patterns expected with the parent(s) and when to call the midwife
 - b. Arrange to see the client and baby at 12 to 24 hours, discuss hypoglycemia with the parent(s) and offer a pre-feeding glucometer glucose reading before a feed at the visit.
 - c. At the day 1 visit (24-48 hours of age), discuss hypoglycemia with the parent(s) and offer a pre-feeding glucometer glucose reading.

SCOPE: This guideline is to be used by midwives for newborns born in out-of hospital settings.

Primary Authors:

Beckie Wood, WRHA Clinical Midwifery Specialist
WRHA Midwifery Practice Council

Dr. Fabiana Postolow, Neonatologist, Assistant Medical Director, IMCN, Health Sciences Centre

Approved by: *Clinical Director of Midwifery Services*