1.0 PURPOSE AND INTENT

1.1 To provide guidelines for identification, monitoring and management of hypoglycemia in newborns in Women’s Health areas and the Neonatal Units within the WRHA. See algorithm in Appendix A.

Note: All recommendations are approximate guidelines only and practitioners must take into 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 and 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. TBG refers to True Blood Glucose, 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 birthweight greater than the 90th percentile on the infant growth chart
- Small for gestational age (SGA) with birthweight 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.

4.2 Immediately after birth and on an ongoing basis assess all newborns of all gestational ages for symptoms of hypoglycemia:
- Jitteriness or tremulousness
- Apathy
- Episodes of cyanosis
- Limpness, lethargy
- Difficulty feeding
- Eye rolling / seizures
- Apnea or tachypnea
- Weak or high-pitched cry
- Episodic sweating, pallor, hypothermia
- Cardiac failure/arrest

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 below and found in Appendix A.

4.5 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.

4.5.2 If infant SGA or 35-36 weeks gestation, check glucometer glucose every 3-4 hours prior to feeds for the first 36 hours.

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

4.6 For asymptomatic infants: Glucometer glucose 1.8-2.5 mmol/L and infant is ≥35 weeks gestation:

4.6.1 Give glucose gel 0.5 mL/kg AND,
4.6.2 Feed baby by breast or 5-10 mL/kg bottle formula or expressed breast milk.
4.6.3 Repeat glucometer glucose 1 hour after feed,
4.6.4 If glucometer glucose 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.
4.6.5 If glucometer glucose < 2.6 mmol/L after 2 doses of glucose gel, send TBG and call care provider to order IV glucose maintenance.
4.6.6 Consider transfer to neonatal unit or neonatology consult for persistent hypoglycemia.

4.7 For symptomatic infants (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:

4.7.1 Give glucose gel 0.5 mL/kg,
4.7.2 Call care provider.
4.7.3 Repeat glucometer glucose 30 minutes after glucose gel,
4.7.4 Start IV D10W at 80 mL/kg/24 hours if infant does not have an IV already,
4.7.5 Give IV bolus D10W 2 mL/kg,
4.7.6 Repeat glucometer glucose 30 minutes after glucose gel,
4.7.7 Determine next steps with care provider based on glucometer glucose result done after glucose gel.

4.9 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.

4.10 Infants cared for in a neonatal unit with hypoglycemia requiring IV treatment:

4.10.1 Continue to monitor glucometer glucose prior to feeds.
4.10.2 Maintain care in the neonatal unit until levels ≥2.6 mmol/L on two consecutive glucometer glucose checks and infant showing no symptoms of hypoglycemia after 6 hours of age.
4.10.3 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.
4.11 For infants > 72 hours of age **with no known etiology for hypoglycemia**: Blood glucose < 2.6 mmol/L measured before one feed by glucometer glucose, OR < 3.3 mmol/L before two consecutive feeds, OR one lab true blood glucose < 3.3 mmol/L - **after a complete assessment**:

4.11.1 Send the following bloodwork to Clinical Chemistry: TBG, Beta-Hydroxybutyrate, Cortisol, Insulin and Growth Hormone. Consider doing a central sample to decrease the chance of hemolysis of the sample.

4.11.2 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 – consult Pediatric Metabolic Service.

4.11.3 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.

4.11.4 If infant of Inuit descent consult Pediatric Metabolic Service for investigation of CPT-1 deficiency.

4.11 For neonates with a confirmed endocrine or metabolic cause for hypoglycemia:

4.11.1 Conduct a 5-6 hour fast prior to discharge in consultation with Pediatric Endocrinologist

4.11.2 Utilize the appropriate discharge checklist as found in Appendix C

4.12 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.

4.13 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.

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6.0 **REFERENCES**


Appendix A

Algorithm

Hypoglycemia Screening and Management in Newborns ≥ 35 weeks

<table>
<thead>
<tr>
<th>Infants at risk for hypoglycemia (including infants of diabetic mothers) Check glucometer glucose at approximately 2 hours after birth and after first feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymptomatic Glucometer Glucose ≥ 2.6 mmol/L</td>
</tr>
<tr>
<td>Asymptomatic Glucometer Glucose 1.8 - 2.5 mmol/L</td>
</tr>
<tr>
<td>Symptomatic Infant: Check glucometer glucose as soon as possible</td>
</tr>
<tr>
<td>Symptomatic &amp; Glucometer Glucose 1.8 - 2.5 mmol/L Or any Glucometer Glucose &lt; 1.8 mmol/L</td>
</tr>
<tr>
<td>In the following sequence:</td>
</tr>
<tr>
<td>- Give glucose gel AND</td>
</tr>
<tr>
<td>- Feed baby – if bottle formula or EBM 5 mL/kg, if breast, ad lib</td>
</tr>
<tr>
<td>- Repeat glucometer glucose 1 hour post-feed</td>
</tr>
<tr>
<td>In the following sequence:</td>
</tr>
<tr>
<td>- Give glucose gel</td>
</tr>
<tr>
<td>- Call care provider</td>
</tr>
<tr>
<td>- Repeat glucometer glucose 30 min post-gel</td>
</tr>
<tr>
<td>- Start IV D10 W at 80 mL/kg/24hr</td>
</tr>
<tr>
<td>- Give IV bolus 2 mL/kg</td>
</tr>
<tr>
<td>- Repeat glucometer glucose in 30 minutes</td>
</tr>
<tr>
<td>Determine next steps with care provider based on results</td>
</tr>
<tr>
<td>Glucometer Glucose 1.8-2.5 mmol/L After 2 glucose gel</td>
</tr>
<tr>
<td>- Send TBS</td>
</tr>
<tr>
<td>- Call care provider</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symptoms of Hypoglycemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jitteriness or tremulousness</td>
</tr>
<tr>
<td>Apathy</td>
</tr>
<tr>
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</tr>
<tr>
<td>Apnea or tachypnea</td>
</tr>
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<td>Weak or high-pitched cry</td>
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<td>Limpness, lethargy</td>
</tr>
<tr>
<td>Difficulty feeding</td>
</tr>
<tr>
<td>Eye rolling / Seizures</td>
</tr>
<tr>
<td>Episodes of sweating, pallor, Hypothermia</td>
</tr>
<tr>
<td>Cardiac failure / arrest</td>
</tr>
</tbody>
</table>

Note: If at any time the baby becomes symptomatic follow the sequence on the right |

Glucometer Glucose ≥ 2.6 mmol/L

TBS = True blood sugar

Care provider = physician, nurse practitioner, midwife, clinical assistant / physician assistant
Appendix B

Instructions for Glucose Oral Gel Preparation and Administration

Materials Required:
Glucose Oral Gel (Instaglucose 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. It may be used for required doses for up to 24 hours kept at room temperature.
### Appendix C

**Discharge Checklist for Infants with Hypoglycemia and Hyperinsulinema**

<table>
<thead>
<tr>
<th>CHECK BOXES AND INITIAL WHEN COMPLETED</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parent or Caregiver Teaching:</strong></td>
<td></td>
</tr>
<tr>
<td>□ Met with the Endocrinology Nurse or physician to discuss diagnosis</td>
<td></td>
</tr>
<tr>
<td>□ Use of glucometer</td>
<td></td>
</tr>
<tr>
<td>□ Target range of blood glucose ______mmol/L to _____mmol/L</td>
<td></td>
</tr>
<tr>
<td>□ At home treatment of hypoglycemia (low blood glucose &lt; 3.2 mmol/L)</td>
<td></td>
</tr>
<tr>
<td>□ Medication teaching (see below)</td>
<td></td>
</tr>
<tr>
<td>□ To contact Pediatric Endocrinology if the blood glucose are frequently too low (&lt;3.2 mmol/L) or too high (&gt;6.0 mmol/L)</td>
<td></td>
</tr>
<tr>
<td>Pediatric Endocrinology nurse: Monday to Friday 8:00am - 4:00 pm at 204-787-2490</td>
<td></td>
</tr>
<tr>
<td>Pediatric Endocrinologist physician on call: 24 hour on call at 204-787-2071</td>
<td></td>
</tr>
</tbody>
</table>

**Medication:**

- □ **Diazoxide**
  - □ Dose of Diazoxide ______ mg every 8 hours = ______ ml every 8 hours by mouth
  - □ Caregiver(s) has been instructed on how to give this medication, by____________________
  - □ Pediatric Endocrinologist has sent prescription to Pharmacy____________________
    (standard concentration for Diazoxide will be 10 mg/mL)

- OR
  - □ **Octreotide**
    - □ Dose of Octreotide is ______ micrograms every _____ hours subcutaneously
    - □ Pediatric Endocrinologist has provided prescription to Pharmacy
      (concentration of Octreotide prescribed is ______ mcg / ______)
    - **Dose = _____ units on a syringe- given every _____ hours**
    - □ Caregiver(s) has been instructed how to give his medication, by____________________

- □ **Glucagon (optional)**
    - □ Caregiver(s) has been instructed how to give intramuscular glucagon in case of emergency
      by___________  Dose _________________mg IM

- □ **IM Hydrocortisone (optional)**
    - □ Caregiver(s) has been instructed how to give intramuscular hydrocortisone in case of emergency by_______  Dose _________________mg IM

**Infant’s Clinical Status:**

- □ Infant must be able to maintain a blood glucose of at least 3.3 mmol/L pre feeds
- □ 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 __________________________

- □ Caregiver has all medications checked off above, in hand prior to discharge
- □ Clinic Follow up Appointment with Pediatric Endocrinology Booked:
  - Date ____________________ Time __________________
# Discharge Checklist for Infants with Hypoglycemia and Hypopituitarism

## Parent or Caregiver Teaching:
- [ ] Met with the Endocrinology Nurse or physician to discuss diagnosis
- [ ] Use of glucometer
- [ ] Target range of blood glucose: _____ mmol/L to _____ mmol/L
- [ ] At home treatment of hypoglycemia (low blood glucose < 3.2 mmol/L)
- [ ] Medication teaching (see below)
- [ ] To contact Pediatric Endocrinology if the blood glucose is frequently too low (<3.2 mmol/L) or too high (>6.0 mmol/L)

**Pediatric Endocrinology nurse:** Monday to Friday 8:00 am - 4:00 pm at 204-787-2490

**Pediatric Endocrinologist physician on call:** 24 hour on call at 204-787-2071

## Medication:
- **Prednisolone (Glucocorticoid):**
  - [ ] Dose of Prednisolone is _____ mg = _____ ml _____ times a day by mouth
  - [ ] Caregiver(s) has been instructed how to give this medication by __________________
  - [ ] Illness management reviewed - dose will be doubled in case of illness or fever
  - [ ] Illness Management Plan Letter provided
  - [ ] Teaching and prescriptions for other pituitary replacement hormones if applicable (growth hormone and/or L-thyroxine and/or DDAVP) (circle if applicable)
  - [ ] Pediatric Endocrinologist has provided prescription to Pharmacy

  (standard concentration for Prednisolone will be 1 mg/ml)

**OR**
- **Growth hormone**
  - [ ] Dose of growth hormone is _____ mg/ day 7 days per week
  - [ ] Caregiver(s) has been instructed how to give this medication by __________________
  - [ ] How to prepare __________________
  - [ ] Pediatric Endocrinology has sent the prescription to NIFB; GH was approved ______________ (date)

- **Glucagon (optional):**
  - [ ] Caregiver(s) has been instructed how to give intramuscular glucagon in case of emergency by __________ Dose ______________ mg IM

- **IM Hydrocortisone (optional):**
  - Caregiver(s) has been instructed how to give intramuscular hydrocortisone in case of emergency by ________ Dose ______________ mg IM

## Infant’s Clinical Status:
- [ ] Infant must be able to maintain a blood glucose of at least 3.3 mmol/L pre feeds
- [ ] 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 __________________

## Discharge Preparation:
- [ ] Caregiver has all medications checked off above, in hand prior to discharge
- [ ] Clinic Follow up Appointment with Pediatric Endocrinology Booked:

Date ____________________ Time ________________