Using Glucose Gel To Reverse Asymptomatic Neonatal Hypoglycemia

Advocate System Wide Implementation
March 8, 2017

Catherine Bennett APN
Perinatal Clinical Nurse Specialist
Advocate Standardization

- A group of Neonatologists, Pediatricians, APNs reviewed literature on neonatal hypoglycemia, including the American Academy of Pediatrics recommendations

- Several Advocate sites have been successfully using gel for 1-2 years with no adverse outcomes noted.

- Decision was made to implement the practice of using 40% glucose gel as a first line treatment for asymptomatic infants

- Go live day: March 8, 2017
Clinical Signs: Defining Symptomatic

- Cyanosis
- Seizures
- Apneic episodes
- Tachypnea
- Weak or high pitched cry
- Floppiness or lethargy
- Poor feeding
- Eye-rolling
- Jitteriness

Critical Assessment Question:
Is the infant symptomatic?
Infants with clinical signs should be tested and treatment initiated immediately.
Background & Current Practice

Neonatal hypoglycemia affects as many as 5-15% of babies

• Standard practices to treat hypoglycemia:
  ❖ Supplemental feeds: formula or expressed breast milk
    Interrupts breast feeding, may lead to nipple confusion, suppresses healthy bifidobacteria and increases the growth of coliform & decreases hospital exclusive breast feeding rates

  ❖ IV glucose with NICU admission
    Increases cost, separates mom and baby, interrupts breast feeding and bonding, decreases time for skin to skin
Neonatal Hypoglycemia

- Neonatal Hypoglycemia (NH) is the *metabolic* condition most responsible for infant admission to NICUs associated with:
  - Preterm Births
  - Gestational Diabetes
  - Pre-eclampsia
“Infants identified as AT RISK” in the Advocate Protocol:

- Small for gestational age: **SGA** (<10%ile BW),
- Large for gestational age: **LGA** (>10%ile BW),
- Infant of a diabetic mother: **IDM**,
- Late Preterm Infant: **LPI** (34 0/7 → 36 6/7 Birth GA),
- Other clinical situations per physician discretion
Growing body of evidence

- ALGH found the number one reason for transfer from mother baby to NICU was transitional neonatal hypoglycemia.

- After review of the study published by Harris et al, ALGH added glucose gel to the hypoglycemia protocol decreasing transfers by 75% for hypoglycemia.
Dextrose gel for neonatal hypoglycemia (the Sugar Babies Study): a randomized, double-blind, placebo-controlled trial

Deborah L Harris, Phillip J Weston, Matthew Signal, J Geoffrey Chase, Jane E Harding

- Methods:
  - Randomized, double-blind, placebo-controlled at tertiary center in New Zealand in 2010
  - Neonates 35-42 weeks gestation < 42 hours old, at risk of hypoglycemia were randomly assigned to 40% dextrose gel (200mg/kg) or placebo gel
    - 514 enrolled babies, 242 became hypoglycemic and were randomized, 237 eligible for analysis:
      - 118 in dextrose gel group
      - 119 in placebo group
Findings:

- Dextrose gel reduced frequency of hypoglycemia
- Neonates receiving dextrose gel were:
  - Less likely to be admitted to NICU for hypoglycemia
  - Less likely to receive IV dextrose
  - Less likely to have episodes of recurrent hypoglycemia
  - Less likely to need expressed breast milk or supplementation with formula

- No serious adverse effects noted
- Well tolerated by neonates

Harris et al, 2014
IMPLEMENTING A PROTOCOL: Using Glucose Gel to Treat Neonatal Hypoglycemia

Catherine Bennett, Elyse Fagan, Edwin Chaharbakhshi, Ina Zamfirova, Jai Flicker

• **Quality Improvement Project:** Development and implementation of a hypoglycemia protocol including the use of glucose gel, May 2014 at ALGH.

• Asymptomatic infants ≥ 35 weeks gestation with blood glucose levels ≤35 mg/dl were given a maximum of 3 doses of dextrose gel (200 mg/kg of 40% dextrose) along with feeds.
Findings:
- NICU transfers from newborn nursery to NICU decreased by 73%
- Glucose gel reversed neonatal hypoglycemia in 88% of neonates (246/278) at risk for hypoglycemia during the first 24 hours of life.
- 50% of women intending to exclusively breastfeed accomplished this
- Mother infant contact increased
- Greatly decreased costs associated with NICU admission
- No adverse events noted
Oral Dextrose Gel Reduces the Need for Intravenous Dextrose Therapy in Neonatal Hypoglycemia

Munmun Rawat, Praveen Chandrasekharan, Stephen Turkovich, Nancy Barclay, Katherine Perry, Eileen Schroeder, Lisa Testa, & Satyan Lakshminrusimha

Method: A retrospective study conducted at the Women and Children’s Hospital of Buffalo, NY before and after implementation of the use of 40% dextrose gel in 2015.

• Asymptomatic infants ≥ 35 weeks gestation with blood glucose levels <45 mg/dl were given a maximum of 3 doses of dextrose gel (200 mg/kg of 40% dextrose) along with feeds.

• 248 infants were included in the pre-implementation group and 250 in the post group.

• Transfer to the NICU for IV dextrose was considered treatment failure.
• Findings:

- Dextrose gel reduced frequency of hypoglycemia
- Neonates receiving dextrose gel had:
  - Lower incidence of transfers from the NBN to the NICU [35/1000 to 25/1000].
  - Lower incidence of needing IV dextrose
  - An increase in exclusive breast feeding [19-28%].
  - Less separation from mother

Rawat et al, 2016
ALGH: Transfers from Mother Baby to NICU for NH Before & After Implementation

Line indicates addition of glucose gel to hypoglycemia
This represents a 73% reduction in the admissions to NICU for neonatal hypoglycemia.

### Infants Admitted to NICU Pre/Post Intervention

<table>
<thead>
<tr>
<th></th>
<th>12 months prior to Implementation</th>
<th>12 months following Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of infants</td>
<td>92 infants</td>
<td>32 infants</td>
</tr>
<tr>
<td>admitted to NICU for NH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of infants at</td>
<td>870 infants</td>
<td>1089</td>
</tr>
<tr>
<td>risk for NH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage</td>
<td>10.6%</td>
<td>2.9%</td>
</tr>
</tbody>
</table>
Outcomes for Infants Receiving Gel

- Remained in Mother Baby
- Transferred to NICU for hypoglycemia
- Transferred to NICU for other condition

- Glucose < 35mg/dL
- Glucose < 25mg/dL
Effect on Exclusive Breastfeeding Rates

• Prior to using gel: most infants were supplemented with formula as a first line treatment

• With use of gel, almost 50% of those stating they wanted to exclusively BF did.
SCREENING AND MANAGEMENT OF ASYMPTOMATIC NEWBORNS AT RISK FOR HYPOGLYCEMIA DURING FIRST 48 HRS OF LIFE

- "AT RISK" = SGA (<10%ile BW), LGA (>10%ile BW), IDM, Late PT (34.0/7 → 36 6/7 Birth GA), other clinical situations per physician discretion
- Bedside Glucose (BG): Screening is based on bedside glucose “BG” (whole blood glucose; typically 10-18% lower than plasma glucose)
- Throughout the algorithm, “feed” refers to maternal preference – breast feeding alone is considered sufficient if this is mother’s choice
- Assess for symptoms before every BG measurement and document in medical record.
  - Contact NICU/provider immediately for symptomatic infants - this screening protocol does not apply.
  - Symptoms include: poor feeding, jitteriness, tremors, floppiness, lethargy, high pitched cry, irritability, grunting, cyanosis, apnea
- Oral Glucose Gel (OGG): dose is 0.5mL/kg → see reverse side for dosing chart

<table>
<thead>
<tr>
<th>Birth → 4 hrs</th>
<th>&gt; 4 → 48 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• <strong>Begin feeding</strong> within 60 min of birth</td>
<td>• Continue feeds q2-3hrs and perform pre-feed BG screen</td>
</tr>
<tr>
<td>• <strong>BG screen #1</strong> at 30 min after completion of first feed</td>
<td>• <strong>Notify NICU/provider and give OGG immediately if:</strong></td>
</tr>
<tr>
<td>• If &gt;35: continue feeds q2-3hrs and perform pre-feed BG screen</td>
<td>• Infant is <strong>symptomatic</strong></td>
</tr>
<tr>
<td>• If &lt;35:</td>
<td>• Infant requires total THREE doses OGG since birth</td>
</tr>
<tr>
<td>• Administer OGG immediately</td>
<td>• <strong>BG below the notification threshold (below):</strong></td>
</tr>
<tr>
<td>• Place skin-to-skin and feed</td>
<td>• &lt;25 at any time after the first OGG dose</td>
</tr>
<tr>
<td>• Repeat BG 1 hr after OGG dose (not 1 hr after feed)</td>
<td>• &lt;35 from &gt; 4 hrs of age</td>
</tr>
<tr>
<td>• <strong>BG screen #2</strong></td>
<td>• &lt;50 at 24-48 hrs</td>
</tr>
<tr>
<td>• If &gt;35: Continue feeds q2-3hrs and perform pre-feed BG screen</td>
<td>• <strong>BG = 35-44</strong></td>
</tr>
<tr>
<td>• If &lt;25: <strong>Notify NICU/provider immediately</strong> &amp; administer OGG</td>
<td>• Administer OGG immediately</td>
</tr>
<tr>
<td>• If 25-34:</td>
<td>• Place skin-to-skin and feed</td>
</tr>
<tr>
<td>• Obtain serum glucose</td>
<td>• Repeat BG 1 hr after OGG dose</td>
</tr>
<tr>
<td>• Administer OGG immediately</td>
<td>• Notify NICU/Provider if &gt; 24 hr of age</td>
</tr>
<tr>
<td>• Place skin-to-skin and feed</td>
<td>• <strong>BG &gt;45</strong></td>
</tr>
<tr>
<td>• Repeat BG 1 hr after OGG dose (not 1 hr after feed)</td>
<td>• OGG dose not needed</td>
</tr>
<tr>
<td>• <strong>BG screen #3</strong></td>
<td>• Continue feeds q2-3hrs and perform pre-feed BG screen</td>
</tr>
<tr>
<td>• If &gt;35, continue feeds q2-3hrs and perform pre-feed BG screen</td>
<td>• Notify NICU/Provider if BG &lt; 50 at &gt;24 hrs</td>
</tr>
<tr>
<td>• If &lt;35: <strong>Notify NICU/provider immediately</strong> &amp; administer OGG</td>
<td><strong>STOP</strong></td>
</tr>
<tr>
<td></td>
<td>WHEN: 4 consecutive values in target range for age in hrs:</td>
</tr>
<tr>
<td></td>
<td>Birth – 4 hr</td>
</tr>
<tr>
<td></td>
<td>&gt;4-24 hr</td>
</tr>
<tr>
<td></td>
<td>&gt;24 – 48 hr</td>
</tr>
</tbody>
</table>

Revised 1.23.2017
DISCLAIMER REGARDING CLINICAL PRACTICE GUIDELINES AND INDIVIDUAL PHYSICIAN/PATIENT DECISION-MAKING

• This clinical guideline provides reasonable thresholds for intervention; there is lack of consensus as to the actual definition of neonatal hypoglycemia, particularly during the first 24 hours of life.

• Infants with whole blood glucose values below 50 (between 24 and 48 hrs of age) or below 60 (at or beyond 48 hrs of age) may be at increased risk for inborn errors of metabolism or endocrine disorders. Close follow up is recommended, and consultation with a pediatric endocrinologist may be appropriate.

• Babies who do not reach a blood glucose of 60 by 48 hrs of age should be watched closely in the outpatient setting for signs and symptoms of metabolic conditions such as CAH.

• These guidelines are designed to assist clinicians by providing an analytical framework for the evaluation and treatment of newborns outside the Newborn Intensive Care Unit or Special Care Nursery with transitional neonatal hypoglycemia. They are not intended to either replace a clinician’s judgment or to establish a protocol for all patients with a particular condition.

• Some patients will not fit the clinical conditions contemplated by a guideline.

• Guidelines will rarely establish the only appropriate approach to a clinical problem. However, guidelines do represent an evidence-based and/or expert consensus regarding the clinical problem and reasons for deviating from the guideline should be apparent in the record.

### 40% ORAL GLUCOSE GEL DOSING CHART

*Recommended dose = 0.5mL/kg*

<table>
<thead>
<tr>
<th>Birth Weight</th>
<th>mL to administer</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2 kg</td>
<td>1 mL</td>
</tr>
<tr>
<td>&gt; 2 – 2.5 kg</td>
<td>1.25 mL</td>
</tr>
<tr>
<td>&gt; 2.5 – 3 kg</td>
<td>1.5 mL</td>
</tr>
<tr>
<td>&gt; 3 – 3.5 kg</td>
<td>1.75 mL</td>
</tr>
<tr>
<td>&gt; 3.5 – 4 kg</td>
<td>2 mL</td>
</tr>
<tr>
<td>&gt; 4 – 4.5 kg</td>
<td>2.25 mL</td>
</tr>
<tr>
<td>&gt; 4.5 – 5 kg</td>
<td>2.5 mL</td>
</tr>
</tbody>
</table>
Neonatal Glucose Levels

- Due to the physiologic low glucose level during the first 2-3 hours of life, the BG low threshold targets in the algorithm change:

  - Birth to 4 hours of life: target 35mg/dL
  - 4-24 hours of life: target is 45 mg/dL
  - 24-48 hours of life: target is 50 mg/dL
Birth to 4 hours: Target \( \geq 35 \text{ mg/dL} \)

**Begin feeding** within 60 min of birth

- **BG screen #1** at 30 min after completion of first feed
- **If \( \geq 35 \)**: continue feeds q2-3hrs and perform pre-feed BG screen
- **If \(< 35\)**
  - Administer Oral Glucose Gel (OGG) immediately
  - Place skin-to-skin and feed
  - Repeat BG 1 hr after OGG dose (not 1 hr after feed)
Birth to 4 hours (cont)

• BG screen #2
• If $\geq 35$: Continue feeds q2-3hrs and perform pre-feed BG screen
• If $<25$: Notify NICU/provider immediately & administer OGG
• If 25-34:
  • Obtain serum glucose
  • Administer OGG immediately
  • Place skin-to-skin and feed
  • Repeat BG 1 hr after OGG dose (not 1 hr after feed)
Birth to 4 hours (cont)

- BG screen #3
- If $\geq 35$, continue feeds q2-3hrs and perform pre-feed BG screen
- If $<35$: Notify NICU/provider immediately & administer OGG
4-48 hours

Continue feeds q2-3hrs and perform pre-feed BG screen

- Notify NICU/provider and give OGG immediately if:
  - Infant is **symptomatic**
  - Infant requires total THREE doses OGG since birth

- BG below the notification threshold (below):
  - <25 at any time after the first OGG dose
  - <35 from > 4 hrs of age
  - <50 at 24-48 hrs
WHEN: 4 consecutive values in target range for age in hrs:

- Birth – 4 hr ≥35
- >4-24 hr ≥45
- >24 – 48 hr ≥50
Example:

Transitional hypoglycemia resolved with 1 dose of gel

<table>
<thead>
<tr>
<th>Time of Birth</th>
<th>BG # 1</th>
<th>Administer gel #1</th>
<th>BG # 2</th>
<th>BG # 3</th>
<th>BG # 4</th>
<th>BG # 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1045</td>
<td>1200</td>
<td>1205</td>
<td>1305</td>
<td>1500</td>
<td>1730</td>
<td>1945</td>
</tr>
<tr>
<td>30 minutes after 1st feed</td>
<td>30mg/dL</td>
<td>46mg/dL</td>
<td>58mg/dL</td>
<td>48mg/dL</td>
<td>49mg/dL</td>
<td></td>
</tr>
<tr>
<td>1200</td>
<td>1205</td>
<td>1305</td>
<td>1500</td>
<td>1730</td>
<td>1945</td>
<td></td>
</tr>
<tr>
<td>30mg/dL</td>
<td>46mg/dL</td>
<td>58mg/dL</td>
<td>48mg/dL</td>
<td>49mg/dL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Example : 3 Strikes You’re Out**

<table>
<thead>
<tr>
<th>Time of Birth</th>
<th>BG # 1</th>
<th>Administer gel #1</th>
<th>BG # 2</th>
<th>BG # 3</th>
<th>BG # 4</th>
<th>Administer gel #2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1045</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1200: 30mg/dL</td>
<td>1205</td>
<td>1305: 55mg/dL</td>
<td>1500: 40mg/dL</td>
<td>1700: 36mg/dL</td>
<td>1705</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BG # 5</th>
<th>BG # 6</th>
<th>BG # 7</th>
<th>Administer gel #3 and call for consult</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 hr after gel</td>
<td>Before feed</td>
<td>Before feed</td>
<td></td>
</tr>
<tr>
<td>1805</td>
<td>2030</td>
<td>2225</td>
<td>2230</td>
</tr>
<tr>
<td>45mg/dL</td>
<td>50mg/dL</td>
<td>30mg/dL</td>
<td></td>
</tr>
</tbody>
</table>
Gel Administration

Supplies:
• 40% Glucose gel
• 3 ml oral syringe
• Medicine cup

1. Squeeze gel into medicine cup
2. Draw up ordered dose
1. Dry the buccal cavities with a sterile 2 x 2.

2. Place partial dose on latex free gloved finger.

3. Massage into buccal mucosa alternating sides until dose is complete.
Ordering Glucose

Newborn Immediate Post Delivery Power Plan

• Glucose gel will be ordered for every newborn with risk factors for hypoglycemia
Check “glucose” for all infants at risk for hypoglycemia

Click on arrow to get the drop down order sentences, round up to closest kg, highlight and select

| Glucose Fingerstick Bedside (Heelstick Glucose) | T: N, Today (Once), PRN, Per Protocol/Guidelines |
| Nursing Communication | T: N, Implement site Glucose Protocol |
| Notify Physician If | T: N, Symptoms of Hypoglycemia: Hypothermia (axillary temp less than 35.3), tremors/jitters, poor tone, lethargy, cyanosis, seizure activity or poor feeding. |
| GLUCOSE [GLUP] | STAT DRAW (Draw STAT/Perform Routine), T: N |
| Treatment of Hypoglycemia with dextrose (Glucose) gel | Order dextrose (glucose) gel for newborn patients at risk for hypoglycemia. Risk factors include: LGA, SGA, IDM, 5 Minute APGAR LESS than 7, Late preterm. Round weight up to the nearest 0.5 kg increment and choose medication. |

0.4 gm, Oral, As Directed PRN, PRN hypoglycemia, Gel, Neonates 2 kg (0.4 gm = 1 mL) For blood glucose LESS than 35 mg/dL during first 4HR of life OR LESS than 40 mg/dL after 4HR of life
0.5 gm, Oral, As Directed PRN, PRN hypoglycemia, Gel, Neonates 2.5 kg (0.5 gm = 1.25 mL) For blood glucose LESS than 35 mg/dL during first 4HR of life OR LESS than 40 mg/dL after 4HR of life
0.6 gm, Oral, As Directed PRN, PRN hypoglycemia, Gel, Neonates 3 kg (0.6 gm = 1.5 mL) For blood glucose LESS than 35 mg/dL during first 4HR of life OR LESS than 40 mg/dL after 4HR of life
0.7 gm, Oral, As Directed PRN, PRN hypoglycemia, Gel, Neonates 3.5 kg (0.7 gm = 1.75 mL) For blood glucose LESS than 35 mg/dL during first 4HR of life OR LESS than 40 mg/dL after 4HR of life
0.8 gm, Oral, As Directed PRN, PRN hypoglycemia, Gel, Neonates 4 kg (0.8 gm = 2 mL) For blood glucose LESS than 35 mg/dL during first 4HR of life OR LESS than 40 mg/dL after 4HR of life
0.9 gm, Oral, As Directed PRN, PRN hypoglycemia, Gel, Neonates 4.5 kg (0.9 gm = 2.25 mL) For blood glucose LESS than 35 mg/dL during first 4HR of life OR LESS than 40 mg/dL after 4HR of life
1 gm, Oral, As Directed PRN, PRN hypoglycemia, Gel, Neonates 5 kg (1 gm = 2.5 mL) For blood glucose LESS than 35 mg/dL during first 4HR of life OR LESS than 40 mg/dL after 4HR of life.
Order Sentences

Treatment of Hypoglycemia with dextrose (glucose) gel

Order dextrose (glucose) gel for newborn patients at risk for hypoglycemia.

Glucose (dextrose (glucose) pediatric oral 40% gel)
0.4 gm, Oral, As Directed PRN, PRN hypoglycemia,

Neonates GREATER than 3.5 to 4 kg (0.8 gm = 2 mL)
For blood glucose LESS than 35 mg/dL during first 4HR of life or LESS than 45 mg/dL after 4HR of life
## Weight Based Dosing of Glucose Gel

<table>
<thead>
<tr>
<th>Birth Weight</th>
<th>mL to administer</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 2 kg</td>
<td>1 mL</td>
</tr>
<tr>
<td>&gt; 2 – 2.5 kg</td>
<td>1.25 mL</td>
</tr>
<tr>
<td>&gt; 2.5 – 3 kg</td>
<td>1.5 mL</td>
</tr>
<tr>
<td>&gt; 3 – 3.5 kg</td>
<td>1.75 mL</td>
</tr>
<tr>
<td>&gt; 3.5 – 4 kg</td>
<td>2 mL</td>
</tr>
<tr>
<td>&gt; 4 – 4.5 kg</td>
<td>2.25 mL</td>
</tr>
<tr>
<td>&gt; 4.5 – 5 kg</td>
<td>2.5 mL</td>
</tr>
</tbody>
</table>
Glucose will be on the MAR as a PRN medication.
Glucose Gel Reminders

- Once gel is administered, the baby should be placed skin to skin and encouraged to breastfeed.

- Skin to skin supports increased glucose levels, thermoregulation, and decreases the neonatal physiologic stress response.

- An ac bedside glucose (BG) should not be obtained sooner than 2 hours after the last normal level. If the infant is cluster feeding, skip one glucose level and wait until the next feeding.

- It is important to look at the big picture when assessing the need to administer gel or continue with glucose checks.
# Population Health

<table>
<thead>
<tr>
<th><strong>Triple Aim</strong></th>
<th><strong>Glucose gel is:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving the patient experience of care (including quality and satisfaction);</td>
<td>Non invasive, decreases mother infant separation</td>
</tr>
<tr>
<td>Improving the health of populations</td>
<td>Effective</td>
</tr>
<tr>
<td>Reducing the per capita cost of health care.</td>
<td>Inexpensive and decreases expensive NICU admissions</td>
</tr>
</tbody>
</table>
Keep the new family together whenever possible


