# NICU Glucose Monitoring and Management Guidelines

- Ongoing assessment and timely intervention should not be limited by these guidelines
- Do not delay treatment if delays in receiving confirmatory lab values
- Individualized assessment required

**Hypoglycemia Symptoms:**
- jitteriness or tremors
- difficulty feeding
- hypothermia
- apnea, episodes of cyanosis, tachypnea
- convulsions, eye rolling weak or high pitched cry, limpness or lethargy
- episodes of sweating, sudden pallor
- cardiac arrest

**Assess Neonate**

**Determine Risk Status**

| High Risk | Moderate Risk | Low Risk |
|---|---|---|
| • IDM, SGA | • Sepsis | • Full TPN |
| • Previous glucose instability | • Post-operative | • Full feeds |
| • Symptomatic hypoglycemia | • Increasing /decreasing PN/feeds | |
| • Medications (see Box A) | • <24 hrs of age | |
| • ≤ 28 wks GA | • New admission | |
| • Recurrent hypoglycemia | • Polycythemia | |
| • Leaking/lost IV | • Decreased TFI | |
| • HIE | | |

**Check glucose (see Box A)**

**Glucometer /Serum Glucose <2.7 mmol/L**
- Notify MD
- Intervention & Treatment (see Box B)

**Glucometer /Serum Glucose 2.7-2.9 mmol/L**
- Notify MD
- Recheck glucose q3h until 3-8 mmol/L

**Glucometer /Serum Glucose 3-8 mmol/L**

Determine Risk Status

| High Risk | Mod. Risk | Low Risk |
|---|---|---|
| Repeat glucometer q8h x 72 h and then q24h until Low risk | Repeat glucometer q12h x 48 h then q24h until Low risk | Repeat glucometer with any bloodwork ordered |

**Glucometer /Serum Glucose >8 mmol/L**
- Send urine for urinalysis to check for glucose and notify MD/NP

| Urine positive for glucose | Urine negative for glucose |
|---|---|
| Notify MD | |
| Recheck glucose q4-8h until ≤8 mmol/L | |

**Critical Labs**
- Indication-infants with persistent and/or unexplained hypoglycaemia
- Must be sent **STAT** if glucose **<2.7 mmol/L**
- **Hypoglycemia requires immediate attention and intervention**
- **Critical labs must be promptly ordered and drawn to prevent delays in implementing treatment**
- Refer to critical lab order set for required labs

**Box A: Points to Remember**
- Send stat glucose in capillary tube for faster results
- Notify lab of need for urgent results
- Delays in processing can result in falsely lower values (up to 1 mmol/hr)
- Excessive squeezing may introduce interstitial fluid which can alter results
- Hematocrit can effect glucose results:
  - High (>0.65) may produce falsely low result
  - Low (<0.25) may produce falsely high result
- Capillary samples drawn routinely for glucose monitoring are less accurate than venous or arterial samples
- Medications that can effect glucose include:
  - Diazoxide, octreotide, dexamethasone, insulin, glucagon, beta blockers (e.g. propranolol), hydrocortisone

**Box B: Treatment Options**
1. IV bolus – an IV bolus of D10W 2ml/kg should be given
   Higher concentrations of dextrose are not recommended.
   Follow-up glucometer in 30 minutes.
2. The dextrose solution is generally increased by 30-50%.
   Follow-up glucometer in 2 hours
3. If there is no IV access, feeding is indicated. Then follow-up glucose in one hour

- A continuous IV solution of glucagon should be considered when the dextrose infusion rate exceeds 10 mg/kg/minute
- If there is ongoing hypoglycaemia, hyperinsulinism should be suspected and refer to the "NICU Management Algorithm for Neonatal Hyperinsulinism" for ongoing management



June 24, 2016

# WHY DO WE DO CRITICAL BLOOD WORK?

## ***WHEN DO WE DO CRITICAL BLOOD WORK?***

For recurrent hypoglycemia (serum glucose < 2.7mmol/L) which may or may not be related to risk factors such as sepsis, asphyxia, prematurity, RDS, IVH, IUGR, SGA or IDM

## ***WHAT CAUSES HYPOGLYCEMIA?***

- Inadequate production of glucose (prematurity)
- Increased glucose utilization (RDS, asphyxia, sepsis etc.)
- Abnormal endocrine regulation of glucose metabolism
  e.g. decreased gluconeogenesis due to primary adrenal insufficiency, hypopituitarism, hypothyroidism, cortisol deficiency

## ***WHAT TESTS DO WE DO TO DIAGNOSE THE UNDERLYING CAUSE OF HYPOGLYCEMIA?***

**CRITICAL BLOOD WORK:**

Electrolytes
Glucose
Lactate
Capillary gas

→ 0.2 ml sent in capillary tube. Send on ice.

Insulin
Growth hormone
Cortisol
Free fatty acids
Beta hydroxybutyrate

→ *3 ml sent in a red top container on ice

*NOTE* if hematocrit is high you will need more blood*

## Glucose Monitoring

**Preamble**

- Glucose has an essential role in providing fuel to many tissues in the body, but is the major substrate of brain metabolism (Kenner et al, 1998)
- Carbohydrate metabolism is a complex system and homeostasis of glucose is of utmost importance
- Normal blood glucose levels are maintained by gluconeogensis (Cornblath & Ichord, 2000)
- Neonatal hypoglycemia can result in neuronal injury (CPS, 2004), while hyperglycemia can result in increased serum osmolarity leading to cell injury and altered cell glucose transport (Avery et al, 1999)

**Standards of Practice**

1. All infants in the NICU will have a glucometer check with any blood sampling. If an infant is having multiple sets of bloodwork in a 24h period, it may not be necessary to do a glucometer check with each set of bloodwork unless clinically indicated (see algorithm).
2. Infants who exhibit symptoms of an altered serum glucose level will automatically be classified as high risk when making decisions about glucose monitoring
3. Symptoms of altered serum glucose levels include one or more of the following: jitteriness or tremors, apnea, episodes of cyanosis, convulsions, tachypnea, weak or high pitched cry, limpness or lethargy, difficulty feeding, eye rolling, episodes of sweating, sudden pallor, hypothermia, cardiac arrest
4. If a glucometer reading of ≤ 3 is obtained, a stat serum glucose will be sent to biochemistry

**Calculation of Neonatal Glucose Requirements:**

**1. Need to know:**

- **Neonate's wt in kg**
- **IV infusion rate in ml/hr**
- **% of dextrose being infused (concentration of glucose/mL)**

**% of Dextrose concentration in IV fluids**

D5W = 50 mg of glucose per mL
D10W = 100 mg of glucose per mL
D12.5W = 125 mg of glucose per mL

**2. Calculation:**

$$\frac{\text{IV rate} \times \text{concentration of glucose/mL}}{\text{neonate's wt in kg}} = \text{mg of glucose/kg/hr}$$

$$\frac{\text{mg of glucose/kg/hr}}{\text{60 minutes/hr}} = \text{mg of glucose/kg/min}$$

**Initial glucose infusion dose: 5-8 mg/kg/min**
**Maximum dose: 11-16 mg/kg/min**


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