

**UNIVERSITY HOSPITAL AT DOWNSTATE/DOWNSTATE HEALTH SCIENCES UNIVERSITY
POLICY AND PROCEDURE**

No. PHARM-100

Subject: Neonatal Hyperglycemia Policy and Procedure
and Management Guideline

Page: 1 of 7

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Department of Pediatrics, Division of Neonatology
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TJC Standards:
MM.16.01.01: The hospital safely
administers medications.

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I. PURPOSE

To provide guidelines for managing hyperglycemia in the neonatal intensive care unit (NICU).

II. POLICY

The medical team shall order continuous intravenous (IV) regular insulin for any infant with plasma or point-of-care (POC) glucose > 220 mg/dL as described in the algorithm below. Pediatric Endocrinology must be called by the medical team at the time of insulin ordering. The medical team shall call the pharmacy (**x2854**) to coordinate and expedite delivery.

The order requires independent verification by two pharmacists. Upon initial verification, the pharmacist shall identify a second pharmacist for verification. The second verifying pharmacist shall document verification via the order notes, then reprint the insulin bag/syringe label to the IV room for preparation.

The insulin bag/syringe shall be hand-delivered to the unit from the pharmacy. Upon receipt of the insulin bag/syringe, the nurse shall connect and prime the IV tubing. The

PHARM-100: Neonatal Hyperglycemia Policy and Procedure and Management Guideline

bag/syringe shall be infused using the Alaris pump, which will be programmed by the nurse and double-checked by a charge nurse (preferred) or staff nurse.

POC glucose shall be monitored as described in the algorithm below. Any changes to the insulin dose shall be transcribed via a new medication order before being adjusted by the nurse on the pump with a double-check by a charge nurse or staff nurse.

III. DEFINITION(s)

A. Neonatal hyperglycemia is plasma or POC glucose > 150 mg/dL.^{1-5:}

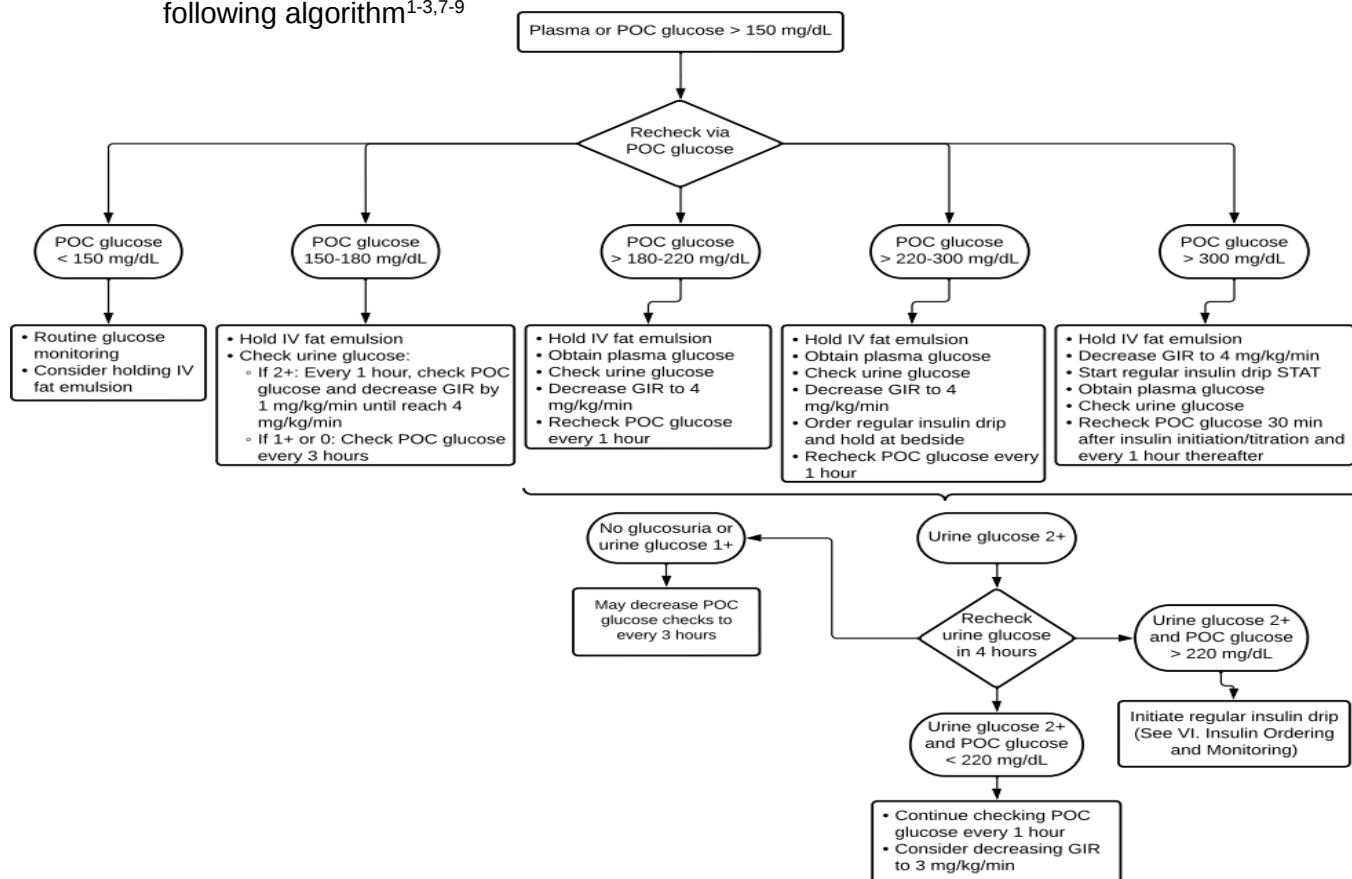
1. Send plasma glucose, i.e., “true glucose,” in a gray-top tube
2. POC done via glucometer device at bedside
3. “Serum glucose” is sent via a red-top tube

IV. RESPONSIBILITIES

Physicians, physician assistants, nurse practitioners, nurses, pharmacists

V. PROCEDURES/GUIDELINES

A single plasma or POC glucose result > 150 mg/dL shall be immediately reported to the physician and rechecked by the nurse using the POC glucometer device. The date/time of the result shall be uploaded from the device and entered into the patient’s chart in the electronic medical record (EMR) by the nurse. The repeat POC glucose value and plasma glucose value will determine subsequent management as described in the following algorithm^{1-3,7-9}



A. INSULIN ORDERING AND MONITORING

1. Regular insulin shall be ordered as a continuous infusion^{1,3,4}:
 - a. Initial dose: 0.01-0.05 units/kg/h
 - b. Titrate by 0.01 units/kg/h
 - c. Max dose: 0.1 units/kg/h (unless remains > 220 mg/dL)

insulin regular drip (NICU) 5 unit/50 mL	
Order	Cost
Insulin Regular Drip (NICU) 5 unit/50 mL - Unit/KILOgram/Hour	

2. Check POC glucose 30 min after the initial dose or titration and every 1 hour thereafter.^{2,4}
3. If POC glucose falls by > 100 mg/dL with the initiation of insulin drip (over 1 hour), decrease the dose by 50%.²
4. If POC glucose is 180-200 mg/dL, decrease the dose by 50%.¹
5. If POC glucose is > 220 mg/dL, increase the dose by 0.01 units/kg/h.
6. If POC glucose remains > 220 mg/dL after titration to a max 0.1 units/kg/h, increase the dose by 50%.²
7. When POC glucose is < 180 mg/dL, discontinue the insulin drip.1
8. If POC glucose is < 150 mg/dL, discontinue the insulin drip if not already discontinued and increase GIR by 2 mg/kg/min.1
9. If POC glucose remains < 150 mg/dL and remains stable for 2 consecutive checks with no changes to insulin dose or GIR, glucose monitoring may be decreased to every 3 hours.^{2,4}
10. **Goal POC glucose: 100-150 mg/dL**
11. Check potassium 4 hours after insulin initiation (also obtain baseline if possible) and every 12 hours if POC glucose remains elevated. Serum potassium shifts are expected to occur.²
12. In case of hypoglycemia (POC glucose < 70 mg/dL), discontinue insulin, give D10% 2 mL/kg, and increase GIR by 2 mg/kg/min.¹

13. Alert attending physician. See policy (POC-05) Adult Prevention and Treatment of Hypoglycemia
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B. PREVENTION AND MANAGEMENT OF HYPEROSMOLARITY

1. Calculate blood osmolarity using POC glucose value:
 - a. Each 18 mg/dL increase in POC glucose increases serum osmolarity by 1 mOsm/L.^{3,5}
 - b. Normal osmolarity is 280-300 mOsm/L. If Osm is > 300 (roughly, serum glucose of 400 mg/dL), **initiate regular insulin drip** and rehydration promptly to prevent cerebral hemorrhage and cellular damage.^{1,3,5}
2. Glucosuria ≥ 1+ increases the risk for osmolarity change.¹
3. Glucosuria ≥ 2+ increases the risk for osmotic diuresis, which results in polyuria and dehydration. Monitor urine output.^{1,3}

C. FLUID MANAGEMENT

1. Decrease dextrose to 5%. If there is an inadequate response, it may decrease to a minimum of 3%.⁵
2. Rehydration¹
3. May add potassium chloride to IV fluids to treat hypokalemia **ONLY** if the patient is urinating

D. NUTRITION MANAGEMENT

1. Increase AA in TPN^{1,2,3,5}
2. Feed enterally if possible to do so safely^{2,3,5}
3. Discontinue fat emulsion 2.5

E. ELECTROLYTE MANAGEMENT

1. Sodium correction for hyperglycemia:
 - a. $Na = \text{serum Na} + 0.016 * (\text{glucose} - 100)$
2. Hyponatremia
 - a. Decrease exposure of the infant to dry air to decrease water losses
 - b. Minimize Na in TPN (e.g., 0.3 mEq NaCl)
 - c. Decrease dextrose to a minimum of 3% if needed in order to facilitate an increase in TFG5

3. Hypophosphatemia²
 - a. May contribute to glucose intolerance
 - b. Correction may confer benefit
4. Hypokalemia – add potassium chloride to IV fluids **ONLY if the patient is urinating**
5. Hyperkalemia – see **Hyperkalemia Protocol**

F. RESPONSIBILITIES OF TEAM MEMBERS

1. Nursing:

- a. If a plasma or POC glucose is > 150 mg/dL or urine glucose is 2+, immediately alert the medical team and repeat POC.
- b. Note the GIR and all medications being administered. Do not discard any medications, e.g., IV fluids.
- c. Measure urine output, urine glucose, POC glucose, plasma glucose (via a gray-top tube), and electrolytes as instructed by the medical team.
- d. Inform the team as soon as the regular insulin drip arrives on the unit.
- e. Connect and prime the IV tubing.
- f. If plasma or POC glucose is > 220 mg/dL, saturate the tubing with insulin for **20 min** before starting insulin to achieve faster target attainment.^{4,6}
- g. Administer the regular insulin drip via the Alaris pump (when POC glucose > 300 mg/dL).
 - i. The infusion rate shall be independently double-checked by the charge nurse if available; otherwise, by a staff nurse.
- h. Do not flush the insulin infusion upon discontinuation; this will administer a bolus insulin dose.⁴
- i. Infusion should be changed every **72 hours** to preserve saturated binding within the tubing.⁶
 - i. *Currently, the bag will expire in 24 hours per IV room sterility standards; I will update as needed.*
- j. POC glucose should be initially monitored every **1 hour** while administering an insulin drip and 30 minutes after any change to the insulin infusion rate.

PHARM-100: Neonatal Hyperglycemia Policy and Procedure and Management Guideline

- k. In case of hypoglycemia, discontinue insulin infusion, detach the tubing from the patient, and alert the medical team.
- l. The RN will document the infant's tolerance to insulin and notify the physician of any signs or symptoms related to the insulin infusion or related to hypoglycemia

2. Physicians, physician assistants, and nurse practitioners:

- a. Address the plasma or POC glucose value according to the above algorithm.
- b. If the glucose value is > 220-300 mg/dL, this is an emergency, and a regular insulin drip should be ordered STAT.
 - i. **Alert the Pediatric Endocrine team.**
 - ii. The ordering provider shall indicate in the regular insulin drip nurse instructions that the drip shall be held at the bedside unless subsequent POC glucose is > 300 mg/dL.
 - iii. If the glucose value is > 300 mg/dL, a regular insulin drip should be started STAT.
 - iv. Prolonged hyperglycemia is associated with more severe outcomes.⁴
- c. It is acceptable to utilize Chem 8 glucose levels for monitoring in place of plasma glucose if POC glucose is < 180 mg/dL.¹
- d. **Gray-top tube ("plasma glucose") is preferred over red-top tube ("serum glucose").**
- e. Evaluate patient/maternal history for possible causes of hyperglycemia, e.g., diabetes mellitus, sepsis, stress, maternal medications, caffeine, corticosteroids, phenytoin, excess glucose intake, and growth restriction.^{1,4}

3. Pharmacy:

- a. Confirm "Regular insulin drip Neonatal Intensive Care Unit (NICU)" ordered and verify for correct dosing and titration parameters.
- b. After verifying the order, identify a second pharmacist for a second independent verification.
 - i. The second pharmacist must indicate the completion of the second verification in the order

PHARM-100: Neonatal Hyperglycemia Policy and Procedure and Management Guideline

notes and then print the label in the IV room for preparation.

- c. Concentration to compound: 0.5 units/mL.² Mix in normal saline.
- d. **Compound STAT per emergency situation.**
- e. Two pharmacist signatures are required before delivery to the unit.
- f. The insulin drip must be hand-delivered to the nurse.
- g. The pharmacist or pharmacy technician must record the delivery time in the IV compounding log book.

VI. ATTACHMENTS

None

VII. REFERENCES

1. Simsek DG, Ecevit A, Hatipoglu N et al. Neonatal Hyperglycemia, which threshold value, diagnostic approach, and treatments? Turkish Neonatal and Pediatric Endocrinology and Diabetes Societies consensus report. Turkish Archives of Pediatrics. 2018;53(Supp 1):234-238. doi: 10.5152/TurkPediArs.2018.01821.
2. Zimmerman and Jackson (2019). Hyperglycemia and the Use of Insulin. University of North Carolina Newborn Critical Care Center: UNC Newborn Critical Care Center (NCCC) Clinical Guidelines.
3. Hemachandra AH and Cowett RM. Neonatal Hyperglycemia. NeoReviews. 1999;20:e16-e24. doi: 10.1542/pir.20-7-e16.
4. Osborn D (2010). Neonatal Hyperglycemia. Royal Prince Alfred Hospital: RPA Newborn Care Protocol Book.
5. Rozance PJ and Hay WW. Neonatal Hyperglycemia. NeoReviews. 2010;11(11):e632-e39. doi 10.1542/neo.11-11-e632.
6. Decaro MH, Vain NE. Hyperglycaemia in preterm neonates: What to know, what to do? Early Human Development 2011; 87: S19-22.
7. Angelis D, Jaleel MA, Brion LP. Hyperglycemia and prematurity: a narrative review. Pediatr Res. 2023 Sep;94(3):892-903. doi: 10.1038/s41390-023-02628-9. Epub 2023 Apr 29. PMID: 37120652.
8. Blanco CL, Kim J. Neonatal Glucose Homeostasis. Clin Perinatol. 2022 Jun;49(2):393-404. doi: 10.1016/j.clp.2022.02.003. Epub 2022 Apr 21. PMID: 35659093.

PHARM-100: Neonatal Hyperglycemia Policy and Procedure and Management Guideline

9. Hay WW Jr, Rozance PJ. Neonatal Hyperglycemia-Causes, Treatments, and Cautions. J Pediatr. 2018 Sep;200:6-8. doi: 10.1016/j.jpeds.2018.04.046. Epub 2018 May 9. PMID: 29753545

DATE REVIEWED	REVISION REQUIRED (CLICK BOX)		RESPONSIBLE STAFF NAME AND TITLE
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