

# Keeping Babies Sweet:

## The Ups And Downs Of Hypoglycemia In The Newborn

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Conference



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## Disclosures

No relevant financial relationship was identified with ineligible companies for anyone with the ability to control content of this presentation.



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## Objectives

1. Describe glucose homeostasis in the newborn versus the fetus.
2. Explain the risk factors and symptoms of hypoglycemia in the newborn.
3. List the immediate and long-term impacts of hypoglycemia in the newborn.
4. Discuss approaches for surveillance and treatment of hypoglycemia in the term and late preterm newborn.



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## How does the fetus get energy?

- Glucose is the major energy source for brain metabolism and vital for normal cell metabolism.
- Before birth, glucose and other necessary substrates for growth and fuel stores are provided to the fetus through the placental circulation.
- The fetus' pancreas produces insulin in response to the placental transfer of glucose and other nutrients.



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## How does the baby get energy after birth?

- After clamping of the umbilical cord, the newborn must use their own stored substrates.
- “Physiologic” hypoglycemia over the first 1-3 hours (as low as 30mg/dL).
- Multiple metabolic processes to source interim energy:
  - Glucose through glycogenolysis and gluconeogenesis.
  - Fatty acids from adipose through lipolysis
  - Ketone bodies through ketogenesis



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## Immediate Harms of Hypoglycemia

- Acute brain injury
- Ischemic stroke
- Seizure



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## Long Term Effects of Hypoglycemia: ...the research is still coming in

- Cerebral palsy
- Blindness
- Visual-motor impairment
- Epilepsy
- Intellectual disability
- Executive dysfunction
- Neurodevelopmental impairment



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## Risk factors for Newborn Hypoglycemia

- Diabetes in the birth parent
- SGA (Small for Gestational Age)
- LGA (Large for Gestational Age)
- Less than 2.5 kg or greater than 4 kg
- Gestation < 37 weeks
- Sepsis
- Asphyxia with labor & birth/ perinatal stress



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## Symptoms of Newborn Hypoglycemia

- Lethargy
- Loss of consciousness
- Tachypnea
- Jitteriness/tremors
- Pallor
- Hypotonia
- Weak or high-pitched cry
- Apnea
- Poor suck/feeding coordination
- Hypothermia
- Cyanosis
- Seizures
- Exaggerated Moro reflex
- Irritability
- Sweating

*Symptoms are non-specific, hypoglycemia symptoms mimic multiple disorders!*



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## Symptoms of Newborn Hypoglycemia: ...not all the same

### Neurogenic

Neural sympathetic discharge in response to hypoglycemia:

- jittery, irritability
- Tachypnea
- Pallor
- sweating

### Neuroglycopenic

Brain dysfunction from impaired brain energy metabolism:

- pathologic poor feeding
- weak/high pitched cry
- change in level of consciousness
- Seizures
- pathologic hypotonia



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## Glucose Gel: A cure or crutch?

- 40% Oral Dextrose Gel, 200 mg/kg (dosing does not have to be precise)
- Administered buccally, absorbed into the through the mucosa
- “Sugar Babies” study showed benefit of adding glucose gel (Harris et al, 2013):
  - More effective than feeding alone to reverse hypoglycemia in 1<sup>st</sup> 48 hours
  - Less formula and expressed breastmilk needed
  - Lower NICU admission for hypoglycemia
  - Less likely to be formula-fed at 2 weeks of age
- Glucose gel initially raises blood sugar, but does not sustain blood sugar level



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## Feeding Supplementation for Hypoglycemia...prevention is key

- Human milk is the optimal source of energy for all neonates during metabolic adaptation
- Encourage active participation of the parent
- Feed early (within first hour)
- Feed frequently feeds (offer at least every 3 hours)
- Assess latch and effective milk transfer at each feeding



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## Feeding Supplementation ... with what?

- Expressed breast milk (colostrum) preferred, followed by donor milk then by formula.
- Hind milk – good source of higher calorie feedings (empty breast completely, pump after feeds)
- Supplement when glucose gel followed by breast/chest feeding ineffective.
- Encourage use of alternative feeding methods vs artificial nipples.



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## Colostrum vs donor milk vs formula

- Formula
  - Effective in the short term, most commonly used
  - Drawbacks include interference with adaptive mechanisms, early exposure to cow's milk protein, interference with breastfeeding, altered gut microbiome
- Pasteurized donor human milk
  - Effective, emerging body of research
  - Higher volume and carbohydrate content than expressed milk, but nutritional content varies
- Expressed milk
  - Higher protein but lower carbohydrate than mature milk
  - Lower volume



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## Protocol Variance to Continue...

- Variability in neonatal clinical response to hypoglycemia
- Unable to establish level or duration of hypoglycemia associated with poor outcomes -- can't define what is clinically significant or a reliable threshold
- Overall goals in management:
  - Reduce harm
  - Identify underlying hypoglycemic disorders
  - Minimize overtreatment for normal transitional low glucose (would resolve without intervention).



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## General Principles of Management

1. Identification of risk factors (antenatal or immediate postpartum)
2. Provision of thermal care
3. Early provision of energy and feeding support
4. Regular monitoring of blood glucose and infusion of IV dextrose when necessary
5. Non-interruption of parent-infant relationship and breastfeeding when possible

Giouleka et al, 2023



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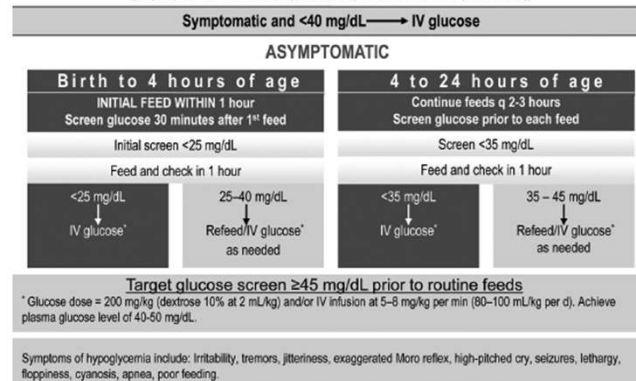
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# American Academy of Pediatrics

## Screening and Management of Postnatal Glucose Homeostasis in Late Preterm and Term SGA, IDM/LGA Infants

[(LPT) Infants 34 – 36<sup>th</sup> weeks and SGA (screen 0-24 hrs); IDM and LGA ≥34 weeks (screen 0-12 hrs)]



American Academy of Pediatrics, 2011

FIGURE 1

Screening for and management of postnatal glucose homeostasis in late-preterm (LPT 34–36<sup>th</sup> weeks) and term small-for-gestational age (SGA) infants and infants who were born to mothers with diabetes (IDM)/large-for-gestational age (LGA) infants. LPT and SGA (screen 0–24 hours), IDM and LGA ≥34 weeks (screen 0–12 hours). IV indicates intravenous.



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# Pediatric Endocrine Society

- High risk, *without* suspected congenital hypoglycemia disorder on normal feedings
  - 1<sup>st</sup> 48 hours of life – target >50 mg/dL
    - If intervention such as IV dextrose needed, target >60 mg/dL
  - After 48 hours of life – target >60 mg/dL
- Suspected congenital hypoglycemia disorder – target >70 mg/dL  
(congenital hyperinsulinism, glucose-6-phosphatase deficiency, fatty acid oxidation disorder, hypopituitarism)

Thornton, et al 2015



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## Management Considerations for Discharge

- Management of newborn hypoglycemia after 24 hours is nuanced, depends on multiple factors and requires medical decision-making:
  - Glucose status – levels, interventions and symptoms
  - Voiding frequency (hydration)
  - Feeding -- feeding frequency, latch/milk transfer and volume (if applicable)
  - Weight – weight for gestation/weight loss
  - Family caregiving
- Feeding plan for discharge needs to correlate with regimen that was successful in hospital.



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# Thank You

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