

NEONATAL HYPOGLYCEMIA

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WHAT IS NEONATAL HYPOGLYCEMIA ?

- Glucose concentration low enough to cause signs and symptoms of impaired brain function
- Normal threshold for neurogenic response < 60 mg/dl
- For safety goal should be blood glucose level >70 mg/dl

WHY NOT FOCUS ON A SPECIFIC GLUCOSE VALUE?

- Brain responses to hypoglycemia vary. Response depends are various factors including:
 - Alternative fuels
 - Previous hypoglycemic events
- No single glucose value is known to cause brain damage in everyone. Value is influenced by duration and degree of hypoglycemia
- Values may be difficult to interpret

WHEN IS HYPOGLYCEMIA “NORMAL” IN A NEONATE?”

- Transitional hypoglycemia may occur during the first 3 days of life
 - > 50 mg/dl
- Infant of mother with diabetes
- Transitional hypoglycemia should be resolved before discharge from the hospital

WHEN TO WORRY

- Infant displays signs and symptoms of hypoglycemia
- Blood glucose level < 50 mg/dl any time

WHIPPLE’S TRIAD

- Signs and symptoms of hypoglycemia
- Documented low blood glucose level
- Resolution of symptoms when blood glucose level is returned to normal

NEONATES AT RISK

- Babies with symptoms of hypoglycemia
- Large for gestational age (mother does not have to have diabetes)
- Babies who experienced perinatal stress

WHAT IS PERINATAL STRESS

- Birth asphyxia or ischemia
- Cesarean section for fetal distress
- Maternal eclampsia/ pre-eclampsia
- Maternal hypertension
- Intrauterine growth restriction (IUGR), small for gestational age (SGA)
- Meconium aspiration
- Hypothermia
- Hematologic concerns: erythroblastosis fetalis, polycythemia

NEONATES AT RISK

- Premature or postmature delivery
- Infant of a diabetic mother
- Family history of genetic form of hypoglycemia
- Sibling with history of hypoglycemia
- Concerns for congenital syndrome associated with hypoglycemia

CONGENITAL SYNDROMES ASSOCIATED WITH HYPOGLYCEMIA

- Overgrowth syndrome (Beckwith Wiedemann)
- Midline facial malformations
- Microphallus

DO NOT DISCHARGE BEFORE PROVEN SAFE FROM HYPOGLYCEMIA

- Episode of hypoglycemia requiring IV dextrose or symptomatic
- Inability to consistently maintain post-prandial glucoses
 - >50 mg/dl up to 48 hours of age and > 60 mg/dl after 48 hours of age
- Family history of genetic form of hypoglycemia
- Congenital syndrome associated with hypoglycemia

SIGNS AND SYMPTOMS OF NEONATAL HYPOGLYCEMIA

- Difficulty breathing
- Mottled skin
- Shaky
- Seizure activity
- Irritability
- Extreme hunger

CHALLENGES IN RECOGNIZING NEONATAL HYPOGLYCEMIA

- Neonates do not always display symptoms of hypoglycemia
- Previous episodes of hypoglycemia can decrease neurogenic response to future episodes for 24 hours (hypoglycemia unawareness)
- Hepatic glucose release is impaired
- HAAF: Hypoglycemia Autonomic Failure

GLUCOSE UTILIZATION

- The brain requires the most glucose
- Infants and young children require more glucose than adults due to their larger brain size
- The brain is able to use ketones or lactate as alternative fuel
- In Hyperinsulinism or Fatty Acid Oxidation Disorders these fuels will not be available in sufficient amounts

PROTECTION FROM HYPOGLYCEMIA

- Suppression of insulin secretion when blood glucose levels are below the normal postabsorptive mean (85 mg/dl)
- Glucagon secretion with as blood glucose level falls
- As blood glucose fall to < 65 mg/dl, growth hormone and cortisol increase

METABOLIC PROTECTION AGAINST HYPOGLYCEMIA

- Release of glucose stores from the liver
- With prolonged fasting glucose utilization is restricted to the liver
- Free Fatty Acids can replace glucose in skeletal and heart muscle – not in the brain
- As ketones rise they can partly increase the brains energy needs

HOW DO WE TEST FOR NEONATAL HYPOGLYCEMIA ?

- Heel Stick
- Ensure the foot is warm
- Repeat level less than 70 mg/dl immediately
- If blood glucose remains <70 mg/dl send confirmatory to the lab

WHEN DO YOU NEED TO SEND A CONFIRMATORY ?

- Any blood glucose < 50 in infant < 48 hours of age should be repeated on bedside glucometer. If repeat < 50 mg/dl- send confirmatory
- Any blood glucose < 60 mg/dl > 48 hour of age should be repeated on bedside glucometer. If repeat < 50 mg/dl- send confirmatory

THE BLOOD SUGAR IS LOW, NOW WHAT

- Re-check on glucometer, send confirmatory if remains low
- If blood glucose > 50 mg/dl feed
- If blood glucose < 50 mg/dl start dextrose

HOW SHOULD NEONATAL HYPOGLYCEMIA BE TREATED?

- Treatment goal should be to keep blood glucose level > 70 mg/dl
- IV dextrose should be initiated as soon as hypoglycemia noted
- IV dextrose may be concentrated to avoid fluid overload

FREQUENT FEEDS AS TREATMENT FOR NEONATAL HYPOGLYCEMIA

- Dextrose should be the only therapy used to treat hypoglycemia
- Frequent/ continuous feeds will lead to the development of feeding aversion

CAUSES OF NEONATAL HYPOGLYCEMIA

- Hyperinsulinism
 - Stress Induced
 - Genetic Mutation
 - No Identifiable Mutation
- Glycogen Storage Disease (GSD)
- Fatty Oxidation Disorder (FFA)

GLUCOSE GOALS

- Neonates with a suspected hypoglycemia disorder and older children with a confirmed hypoglycemia disorder:
 - Maintain blood glucose > 70 mg/dl
- High-risk neonates without a suspected congenital hypoglycemia disorder:
 - < 48 hours old, maintain BG > 50 mg/dl
 - > 48 hours old, maintain BG > 60 mg/dl

TESTING FOR NEONATAL HYPOGLYCEMIA

- Fasting Study:
 - Neonates should be able to fast 24 hours
 - Need to ensure that babies are safe to fast > 70 mg/dl
 - "Skip a feed"
 - Fasting Study

FASTING A NEONATE

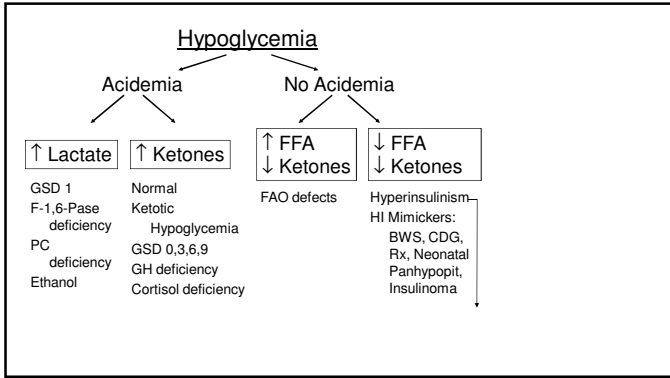
- 24 hours
- NPO except for ¼ NSS
 - Po or IV hydration
- Prepare family
- Plan for "skip a feed" if suspect stress induced hypoglycemia with values > 50 mg/dl

CRITICAL SAMPLE

- Basic Metabolic Panel
- Beta-hydroxybuterate
- Ammonia
- Lactate
- Cortisol
- Growth Hormone
- Insulin

CRITICAL SAMPLE

- C-Peptide
- Free Fatty Acids
- IGF-BP1
- Free and total carnitine
- Acylcarnitine Profile
- Urine Organic Acids- try bagging. If not sooner obtain first void after fast. Obtain within 2-4 hours of fast ending



PREPARING TO OBTAIN THE CRITICAL SAMPLE

- Ask for help
- Label tubes ahead of time
- Now volume required for each test
- Have a blood drawing IV
 - Don't have placed to early
 - Don't wait to long to have placed

CAUSES OF NEONATAL HYPOGLYCEMIA

- Finding : Low beta hydroxy buterate (BHOB) and low free fatty acids (FFA)
- Hyperinsulinism
- Hypopituitarism
- Transitional Neonatal Hypoglycemia
- Perinatal Stress Hyperinsulinism

CAUSES OF NEONATAL HYPOGLYCEMIA

- Findings: Low BHOB and elevated FFA
- Fatty Acid Oxidation Defects

CAUSES OF NEONATAL HYPOGLYCEMIA

- Findings: Elevated lactate
- Gluconeogenesis defects
 - GSD (Glycogen Storage Disease)

CAUSES OF NEONATAL HYPOGLYCEMIA

- Findings: Elevated BHOB
- Ketotic Hypoglycemia
- Glycogenoses
- Growth Hormone (GH) Deficiency
- Cortisol Deficiency

PREPARING THE FAMILY FOR THE FAST

- Review the importance- to ensure their child is safe
- Be clear that their baby may “hang in the 50s mg/dl” for “a long time”
- Review the process of obtaining a confirmatory sample
- Review the glucagon stim

SAFE DISCHARGE FOR A NEONATE WITH HYPOGLYCEMIA

- You must be sure that the baby can safely fast between feedings
- You must be certain that if the baby will be able to skip a feeding
- Family must be taught blood glucose monitoring
- Family must have glucometer and supplies prior to discharge
- Family must be aware of blood glucose values to call for
- Family must have rescue plan
- If being discharged with glucagon, teaching must be completed
- Family must have glucagon prior to discharge

ENDOCRINE FOLLOW UP FOR A NEONATE WITH HYPOGLYCEMIA

- The baby stayed > 70 mg/dl for 6 hours, what happens when they start sleeping longer ?
- When does the fast need to be repeated ?
- How long does the family need to follow in Endocrine clinic ?
