Neonatal Hypoglycemia

Infants who are SGA are frequently hypoglycemic, and this may be the result of malnutrition in utero. Some of these infants secrete inappropriately large amounts of insulin in response to glucose and for this reason may suffer from serious hypoglycemia. In addition, hepatic glycogen stores are inadequate, and deficient gluconeogenesis exists. Preterm infants may be hypoglycemic without demonstrable symptoms, therefore necessitating close monitoring of blood glucose levels.

ANESTHETIC CONSIDERATIONS:

- Sequelae of prolonged hypoglycemia:
  - irreversible CNS damage
  - convulsions
  - respiratory distress, apnea
  - temperature instability, sweating
- Increased incidence of congenital anomalies (in infants of diabetic mothers)
- Co-existing maternal and fetal factors

ANESTHETIC GOALS:

- Maintain normoglycemia
- Careful titration of glucose according to an infant's needs as measured by plasma blood glucose levels
- It may be prudent to keep serum glucose concentrations at greater than 2.2mmol/L in all newborns

DEFINITIONS

- plasma glucose levels less than :
  - 1.9 mmol/L in the first 3 hours of life
  - less than 2.2 mmol/L between 3 and 24 hours
  - less than 2.5 mmol/L after 24 hours.
- Others have defined hypoglycemia in full-term infants as a serum glucose concentration of less than 1.7 mmol/L in the first day of life or less than 2.2mmol/L in the second day of life

HISTORY/ PHYSICAL

- Signs and symptoms of hypoglycemia
  - respiratory distress
  - apnea
  - cyanosis
  - seizures
  - tremors
  - high-pitched cry
  - irritability
  - lethargy
  - eye rolling
  - poor feeding
  - temperature instability
  - sweating
  - signs and symptoms in infants are often blunted and nonspecific

- Underlying disease
  - Sepsis
  - Congenital heart disease
  - RDS/ppHTN
  - Fetal macrosomia or IUGR
  - Prematurity
  - Insulinoma
  - Inborn errors of metabolism

INVESTIGATIONS

- Serum Glucose
- CBC ,lytes, BUN, Cr
- Plasma insulin level

OPTIMIZATION

- (SGA) infants have very high glucose requirements; they require glucose infusion rates of 8 to 10 mg/kg/min. In full-term infants, a glucose infusion rate of 5 to 8 mg/kg/min is required to prevent hypoglycemia
- studies reveal that administration of hypertonic solutions increases the incidence of intraventricular hemorrhage in preterm infants. For this reason, it is prudent to avoid bolus administration of hypertonic glucose to treat hypoglycemia to prevent sudden changes in blood tonicity and hyperglycemia

MANAGEMENT OF ANESTHESIA

- Infants undergoing surgical procedures often require less glucose supplementation. This reduced need may be attributed to hormonal responses that decrease glucose uptake as a result of catecholamine release in excess of insulin activity, as well as a decrease in metabolic demand owing to the effects of the anesthetic agents.
- Nevertheless, it is important to administer glucose-containing solutions using a constantinfusion device to avoid large fluctuations in blood glucose values and to monitor blood glucose values in critically ill newborns.

- All other fluids replaced (third-space losses, blood loss, deficits) should be glucose free to avoid hyperglycemia.
- Because infants treated with high levels of glucose via total parenteral nutrition (TPN) may develop severe hypoglycemia if the infusion level is abruptly changed, it is important to continue these infusions (possibly at a slightly reduced rate) during surgery and to check the serum glucose levels

OBSTETRICS

- Maternal hyperglycemia, particularly when uncontrolled, results in hypertrophy and hyperplasia of the fetal islets of Langerhans. This leads to increased levels of insulin in the fetus, affecting lipid metabolism and giving rise to a large, overweight infant characteristic of a mother with poorly controlled diabetes. Hyperglycemia alone is not instrumental in this effect; it may also be the result of an increase in serum amino acids found in diabetic mothers. Meticulous control of a mother's diabetes during pregnancy and delivery has led to a reduction in morbidity and mortality of the infants of diabetic mothers. Hyperinsulinemia of the fetus persists after birth and may lead to rapid development of serious hypoglycemia. In addition to severe hypoglycemia, these infants have an increased incidence of congenital anomalies

PATHOPHYSIOLOGY

- Hypoglycemia is the most common metabolic problem occurring in newborn infants. Inadequate glycogen stores and deficient gluconeogenesis are important factors in the newborn's susceptibility to hypoglycemia. The incidence of symptomatic hypoglycemia is highest in small-for-gestational age infants. Infants may be at risk of hypoglycemia due to alterations in maternal metabolism, intrinsic neonatal problems, and endocrine or metabolic disorders

- **Causes of Neonatal Hypoglycemia**

A. Maternal factors

1. Intrapartum administration of glucose
2. Drug treatment
   - **a.** β-adrenergic blocking agents (terbutaline, ritodrine, propranolol)
   - **b.** Oral hypoglycemic agents
   - **c.** Salicylates
3. Maternal diabetes/gestational diabetes

B. Neonatal factors

1. Depleted glycogen stores
   - **a.** Asphyxia
   - **b.** Perinatal stress
2. Increased glucose utilization (metabolic demands)
   - **a.** Sepsis
   - **b.** Polycythemia
   - **c.** Hypothermia
   - **d.** Respiratory distress syndrome
   - **e.** Congestive heart failure (cyanotic congenital heart disease)
3. Limited glycogen stores
   - **a.** Intrauterine growth retardation
   - **b.** Prematurity
4. Hyperinsulinism/endocrine disorders
   - **a.** Infants of diabetic mothers
   - **b.** Erythroblastosis fetalis, fetal hydrops
   - **c.** Insulinomas
   - **d.** Beckwith-Wiedemann syndrome
   - **e.** Panhypopituitarism
5. Decreased glycogenolysis, gluconeogenesis, or utilization of alternate fuels
   - **a.** Inborn errors of metabolism
   - **b.** Adrenal insufficiency

REFERENCES

- Cote, A Practice of Anesthesia for Infants and Children, 4th Edition
- Stoelting's Anesthesia and Co-Existing Disease, 5th Edition