Galactosemia

Charles Fox III | Rachel J. Kaye | Alan David Kaye

Risk

- Rare autosomal recessive metabolic disorder that can present increased anesthesia risks.
- Inherited disease of carbohydrate metabolism affecting how the body processes the simple sugar galactose. The primary risk factor is having parents who carry the gene for galactosemia.
- Life-threatening complications in the newborn may occur shortly after introducing galactose into the diet.
- Three types of galactosemia:
  - Type I (classic galactosemia) involves a deficiency of GALT enzyme. This is the most common form of the disease, with overall incidence between 1:40,000 and 1:60,000 in USA.
  - Type II occurs in fewer than 1:100,000.
  - Type III is very rare.

Perioperative Risks

- Commonly causes renal, liver, neural, and ophthalmic imbalances.
- Abnormal liver function tests will document extent of liver damage.
- Due to liver damage, these pts may experience abnormal bleeding both intraop and postop. If undergoing a cardiac procedure requiring bypass, heparinization will compound the risk of bleeding.
- These pts are prone to *Escherichia coli* neonatal sepsis, so extra precautions should be used if placing intravascular catheters.
- Drugs that are metabolized by the liver or found to be hepatotoxic should be avoided in these pts.
- Intravascular volume may be depleted in these pts due to poor feeding, vomiting, and/or diarrhea, which commonly exists in these pts.
- Neurodevelopment problems are common and sometimes severe. Ataxia and intention tremor may occur in older children and adults.
- Renal tubular acidosis, galactosuria, and albuminuria are common with these patients.
- Hemolytic anemia due to an increase in red blood cell galactose-1-phosphate is not unusual.

Worry About

- Long term complications:
  - Stunted growth
  - Learning disabilities
  - Speech/language problems
  - Fine and gross motor skill delays
  - Ovarian failure
  - Decreased bone mineral density (lack of dairy products in diet)

Overview

- Type I is referred to as classic galactosemia and results from a deficiency of the enzyme called GALT. GALT changes galactose to glucose. It usually presents in the neonatal period with life-threatening illness.
- Type II is a less severe form due to low levels of galactose kinase.
- Type III is a form with variable severity due to low levels of galactose epimerase.

Etiology

- Lactose is broken down into glucose and galactose. In individuals with galactosemia, the ability to further break down galactose is impaired or missing. This leads to increased and/or toxic levels of galactose-1-phosphate. Without treatment, in neonates, mortality approaches 75%. Classic galactosemia is an autosomal recessive disorder, meaning a child must inherit one defective gene from each parent.
- An infant with galactosemia appears normal at birth. Within the first few days or weeks of life after the baby is introduced to breast milk or a lactose-containing formula, symptoms begin to occur, which may include:
  - Excessive bleeding.
  - Encephalopathy.
  - Cataracts.
  - Hepatomegaly.
  - Hypotonia.
  - Lethargy.
  - FTT.
  - Delayed development.
  - Feeding problems.
  - Vomiting.
  - Diarrhea.
  - Jaundice.
  - Infection.
  - Neonatal death.
- Dx: Blood tests can reveal increased levels of galactose and galactose-1-phosphate. DNA tests look for mutations in GALT gene. Newborn screening tests should check for GALT enzyme.

Usual Treatment

- Lactose and galactose-free diet, with the following precautions:
  - Milk and all dairy products should be avoided.
  - Processed and prepackaged foods should be screened for lactose.
  - Infants should consume special lactose-free formula, including soy formula, meat-based formula, or Nutramigen (a protein-based formula).
- Calcium supplements.
- Supportive care should be provided depending on severity of liver, renal, and central nervous system disease. Antibiotics, IV fluids, plasma, and vitamin K are frequently needed.
- Drug considerations: A majority of medications, particularly tablets, contain lactose—these should be avoided. Avoid drugs that may be hepatotoxic or require extensive liver metabolism.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
CV	Prolonged QT syndrome			ECG
GI	Liver dysfunction		Ascites Vomiting Diarrhea Jaundice in newborn	Unconjugated or combined hyperbilirubinemia Abnormal LFTs Abnormal clotting
RENAL	Renal tubular dysfunction			Metabolic acidosis on blood gas Urine-albumin, aminoaciduria
HEME	Anemia (hemolytic) Risk of bleeding		Easy bruising	Coombs test Increased bleeding times, increased PT and PTT Low Hct and Hgb
NEURO			Impaired mental abilities	
IMMUNE	Increased incidence of *E. coli* septicemia		Hypotension, tachycardia	Blood cultures

Key References: Bosch AM: Classic galactosemia revisited, *J Inherit Metab Dis* 29(4):516–525, 2006; Choudhury A, Das S, Kiran U: Anaesthetic management of a newborn with galactosemia for congenital heart surgery, *Indian J Anaesth* 53(2):219–222, 2009.

Perioperative Implications

Preoperative Preparation

- Pts with galactosemia have elevated bleeding times and are at risk for increased bleeding during surgery.
- Hypoalbuminuria can cause an osmotic shift by diuresis. Urine volume is a poor predictor of intravascular volume in these pts. They may need preop fluid to replace deficits.
- These pts are prone to *E. coli* sepsis.

Monitoring/Induction/Maintenance

- Standard ASA monitors, with supplementation of invasive monitoring if risk factors present.
- Precautions should be undertaken when placing vascular access. These pts are prone to *E. coli* sepsis. Pts with long-standing gout may have coexisting nephropathy. Consideration should be made to adjust the dose of renally cleared paralytics and analgesics.
- Medications that cause hepatotoxicity or are metabolized by the liver should be avoided.
- Intraop hypotension should be treated aggressively, since these pts already suffer from hepatic and renal impairment.

Postoperative Period

- Preop hypotonia could predict respiratory issues.
- Hypotension should be treated aggressively.