Test Definition: GALT

Galactose-1-Phosphate Uridyltransferase, Blood

Overview

Useful For

Diagnosis of galactose-1-phosphate uridyltransferase deficiency, the most common cause of galactosemia

Confirmation of abnormal state newborn screening results

Genetics Test Information

Galactose-1-phosphate uridyltransferase (GALT) deficiency is the most common cause of galactosemia and requires lifelong restriction of dietary galactose.

Classic galactosemia can be diagnosed by analysis of GALT enzyme.

This test provides enzymatic testing for the diagnosis of GALT deficiency.

Testing Algorithm

For more information see Galactosemia Testing Algorithm.

Special Instructions

- Informed Consent for Genetic Testing
- Galactosemia Testing Algorithm
- Biochemical Genetics Patient Information
- Informed Consent for Genetic Testing (Spanish)
- Galactosemia-Related Test List

Method Name

Enzyme Reaction followed by Liquid Chromatography Tandem Mass Spectrometry (LC-MS/MS)

NY State Available

Yes

Specimen

Specimen Type

Whole Blood EDTA

Ordering Guidance

This assay is not appropriate for monitoring dietary compliance. If dietary monitoring is needed, order GAL1P / Galactose-1-Phosphate, Erythrocytes.

Test Definition: GALT

Galactose-1-Phosphate Uridyltransferase, Blood

This test is for galactose-1-phosphate uridyltransferase (GALT) enzyme testing only. The preferred test to evaluate for possible diagnosis of galactosemia, routine carrier screening, and follow-up of abnormal newborn screening results is GCT / Galactosemia Reflex, Blood.

This assay will not detect galactokinase (GALK) deficiency or uridine diphosphate-galactose 4' epimerase (GALE) deficiency.
-To evaluate for GALK deficiency, order GALK / Galactokinase, Blood.
-To evaluate for GALE deficiency, order GALE / Uridine Diphosphate -Galactose 4' Epimerase, Blood.
-To evaluate for GALM deficiency, order GALP / Galactose, Plasma and molecular analysis of the *GALM* gene.

Necessary Information

Patient's age is required.

Biochemical Genetics Patient Information (T602) is recommended, but not required, to be filled out and sent with the specimen to aid in the interpretation of test results.

Specimen Required

Multiple whole blood tests for galactosemia can be performed on 1 specimen. Prioritize order of testing when submitting specimens. For a list of tests that can be ordered together see Galactosemia-Related Test List.

Container/Tube:
Preferred: Lavender top (EDTA)
Acceptable: Green top (sodium heparin) or yellow top (ACD)
Specimen Volume: 5 mL

Forms

1. **New York Clients-Informed consent is required.** Document on the request form or electronic order that a copy is on file. The following documents are available:
-Informed Consent for Genetic Testing (T576)
-Informed Consent for Genetic Testing-Spanish (T826)
2. Biochemical Genetics Patient Information (T602) is recommended.
3. If not ordering electronically, complete, print, and send a Biochemical Genetics Test Request (T798) with the specimen.

Specimen Minimum Volume

2 mL

Reject Due To

Gross hemolysis	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container

Whole Blood EDTA	Refrigerated (preferred)	28 days	
	Ambient	14 days	

Clinical & Interpretive

Clinical Information

Galactosemia is an autosomal recessive disorder that results from a deficiency of any 1 of the 4 enzymes catalyzing the conversion of galactose to glucose: galactose-1-phosphate uridyltransferase (GALT), galactokinase (GALK), uridine diphosphate galactose-4-epimerase (GALE), and galactose mutarotase (GALM). GALT deficiency is the most common cause of galactosemia and is often referred to as classic galactosemia. The complete or near-complete deficiency of GALT enzyme is life threatening if left untreated. Complications in the neonatal period include failure to thrive, liver failure, sepsis, and death.

Galactosemia is treated by a galactose-restricted diet, which allows for rapid recovery from the acute symptoms and a generally good prognosis. Despite adequate treatment from an early age, individuals with galactosemia remain at increased risk for developmental delays, speech problems, and abnormalities of motor function. Female patients with galactosemia are at increased risk for premature ovarian failure. Based upon reports by newborn screening programs, the frequency of classic galactosemia in the United States is approximately 1 in 30,000, although literature reports range from 1 in 10,000 to 1 in 60,000 live births.

Galactose-1-phosphate (Gal1P) accumulates in the erythrocytes of patients with galactosemia. The quantitative measurement of Gal1P (GAL1P / Galactose-1-Phosphate, Erythrocytes) is useful for monitoring compliance with dietary therapy. Gal1P is thought to be the causative factor for development of liver disease in these patients and, because of this, patients should maintain low levels and be monitored on a regular basis.

Duarte-variant galactosemia (compound heterozygosity for the Duarte variant, N314D and a classic variant) is generally associated with higher levels of enzyme activity (5%-20%) than classic galactosemia (<5%); however, this may be indistinguishable by newborn screening assays. Previously, it was unknown whether children with Duarte-variant galactosemia were at an increased risk for adverse developmental outcomes due to milk exposure and were often treated with a low galactose diet during infancy. More recently, the outcomes data suggest a lack of evidence for developmental complications due to milk exposure, therefore treatment recommendations remain controversial. The Los Angeles variant, which consists of N314D and a second variant, L218L, is associated with higher levels of GALT enzyme activity than the Duarte-variant allele.

Newborn screening for galactosemia is performed in all 50 US states, though the method by which potentially affected individuals are detected varies from state to state and may include the measurement of total galactose (galactose and Gal1P) and/or determining the activity of the GALT enzyme. The diagnosis of galactosemia is established by follow-up quantitative measurement of GALT enzyme activity. If biochemical testing has confirmed the diagnosis of galactosemia, sequencing of the *GALT* gene (GALZ / Galactosemia, *GALT* Gene, Full Gene Analysis, Varies) is available to identify private variations.

For more information see Galactosemia Testing Algorithm.

Reference Values

> or =24.5 nmol/h/mg of hemoglobin

Interpretation

Results below 24.5 nmol/h/mg of hemoglobin in properly submitted specimens have different causes from carrier status for a disease-causing variant in the *GALT* gene (typically reduced galactose-1-phosphate uridyltransferase [GALT] activity close to the normal activity range) to "Classic Galactosemia" due to biallelic disease-causing variants in the *GALT* gene that abolish GALT activity. Further differentiation requires additional biochemical and molecular genetic analyses as well as correlation with clinical signs and symptoms.

Normal results (> or =24.5 nmol/hour/mg of hemoglobin) are not consistent with galactosemia due to GALT deficiency.

For more information see Galactosemia Testing Algorithm.

Cautions

The results of testing performed in erythrocytes, including analysis of enzymes, biochemical phenotyping, or galactose-1-phosphate are invalid following a transfusion. Patients should wait 3 to 4 months post transfusion before collecting whole blood for galactose-1-phosphate uridyltransferase testing.

Clinical Reference

1. Berry GT. Classic galactosemia and clinical variant galactosemia. In: Adam MP, Feldman J, Mirzaa GM, et al. eds. GeneReviews [Internet]. University of Washington, Seattle; 2000. Updated March 11, 2021. Accessed September 12, 2024. Available at www.ncbi.nlm.nih.gov/books/NBK1518/
2. Walter JH, Fridovich-Keil JL. Galactosemia. In: Valle D, Antonarakis S, Ballabio A, Beaudet AL, Mitchell GA, eds. The Online Metabolic and Molecular Bases of Inherited Disease. McGraw-Hill; 2019. Accessed September 12, 2024. Available at https://ommbid.mhmedical.com/content.aspx?bookid=2709&sectionid=%20225081023
3. Carlock G, Fischer ST, Lynch ME, et al. Developmental outcomes in Duarte galactosemia. Pediatrics. 2019;143(1):e20182516. doi:10.1542/peds.2018-2516
4. Anderson S. GALT deficiency galactosemia. MCN Am J Matern Child Nurs. 2018;43(1):44-51. doi:10.1097/NMC.0000000000000388

Performance

Method Description

An aqueous mixture containing water, uridine diphosphate (UDP)-glucose, (13)C2-labeled galactose-1-phosphate, and UDP-N-acetylglucosamine (internal standard) is added to a hemolysate aliquot. The mixture is then vortexed briefly and incubated at 37 degrees C for 15 minutes.

After incubation the reaction is quenched, extracted, and centrifuged. The top layer is then transferred to a 96-well plate. Then injected onto a liquid chromatography tandem mass spectrometry (LC-MS/MS). The ratio of the extracted peak area of (13)C2-labeled UDP-galactose to its internal standard UDP-N-acetylglucosamine as determined by LC-MS/MS is used to calculate the concentration of product analyte in the sample. The concentration of the product is then normalized using the calculated hemoglobin concentration to determine the patient's enzyme level in nmol/h/mg

of hemoglobin.(Unpublished Mayo method)

PDF Report
No

Day(s) Performed
Monday, Wednesday, Friday

Report Available
4 to 7 days

Specimen Retention Time
Processed RBC: 2 months

Performing Laboratory Location
Mayo Clinic Laboratories - Rochester Main Campus

Fees & Codes

Fees
- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact Customer Service.

Test Classification
This test was developed and its performance characteristics determined by Mayo Clinic in a manner consistent with CLIA requirements. It has not been cleared or approved by the US Food and Drug Administration.

CPT Code Information
82775

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
GALT	Gal-1-P Uridyltransferase, RBC	24082-0

Result ID	Test Result Name	Result LOINC® Value
8333	Gal-1-P Uridyltransferase, RBC	24082-0
2296	Interpretation (GALT)	59462-2
58115	Reviewed By	18771-6