Test Definition: GALTP

Galactose-1-Phosphate Uridyltransferase
Biochemical Phenotyping, Erythrocytes

Overview

Useful For

Determining the biochemical phenotype for galactosemia when enzymatic and molecular results are incongruent

Additional Tests

Test Id	Reporting Name	Available Separately	Always Performed
GALT	Gal-1-P Uridyltransferase, RBC	Yes	Yes

Testing Algorithm

A quantitative galactose-1-phosphate uridyltransferase (GALT) level is used in addition to the isoelectric focusing for accurate interpretation. If recent GALT test results are not provided, GALT testing will be automatically performed at an additional charge. However, if previous GALT results are provided, GALT testing will be canceled.

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

Isoelectric Focusing

NY State Available

Yes

Specimen

Specimen Type

Whole Blood EDTA

Ordering Guidance

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.

For monitoring of dietary compliance, order GAL1P / Galactose-1-Phosphate, Erythrocytes.

Necessary Information

Patient's age is required.

A quantitative galactose-1-phosphate uridyltransferase level (GALT / Galactose-1-Phosphate Uridyltransferase, Blood) is required for accurate interpretation.

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: Lavender top (EDTA)
Specimen Volume: 3 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.

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.

In general, molecular genetic analysis (GALZ / Galactosemia, *GALT* Gene, Full Gene Analysis, Varies) is typically performed to determine the specific genotype. If the enzymatic and molecular results are incongruent, biochemical phenotyping may be beneficial to help clarify results to determine a treatment strategy and recurrence risks.

For more information see Galactosemia Testing Algorithm.

Reference Values

An interpretative report will be provided.

Interpretation

Different banding patterns obtained by isoelectric focusing of galactose-1-phosphate uridyltransferase (GALT) can be consistent with classic galactosemia, carrier status for a disease-causing *GALT* variant, compound heterozygosity, or a normal biochemical phenotype. The banding pattern is interpretated in the context of the separately measured GALT activity.

Cautions

A more comprehensive interpretation can be provided when parental specimens are also submitted for testing.

The results of testing performed in erythrocytes, including analysis of enzymes, biochemical phenotyping, or galactose-1-phosphate, are invalid following a transfusion.

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

Isoelectric focusing is used to resolve the isoenzymes of galactose-1-phosphate uridyltransferase (GALT). The band patterns, when used in conjunction with a quantitative GALT result, can be used to predict the GALT phenotype of an individual.

In isoelectric focusing, a pH gradient is established across an agarose gel by adding a select mixture of amphoteric molecules to the gel and applying an electric field to the gel. Each protein (isoenzyme) has its own unique isoelectric point, a pH at which the net charge of the protein is equal to zero. Therefore, if a protein is applied to the gel, it will migrate through the pH gradient in the gel until it reaches its isoelectric point. There the protein will stop and "focus" into distinct bands.

In this procedure, a red blood cell hemolysate is focused on a 5% agarose gel containing ampholytes of a 5 to 7 pH range. The isoenzyme bands are then visualized by applying a substrate mixture that results in a series of reactions (shown below). The final product, reduced nicotinamide adenine dinucleotide phosphate (NADPH), is stained a blue-violet color when it reacts with phenazine methosulfate and 3-(4-5 dimethylthiazol-2-yl) I-2,5-diphenyltetrazolium bromide.(Shin YS, Niedermeier HP, Endres W, Schaub J, Weidinger S. Agarose gel isoelectrofocusing of UDP-galactose pyrophosphorylase and galactose-1-phosphate uridyltransferase. Developmental aspect of UDP-galactose pyrophosphorylase. Clin Chim Acta. 1987;166[1]:27-35, modified to acrylamide as described by Leclerc P, Forest JC. Electrophoretic determination of isoamylases in serum with commercially available reagents. Clin Chem. 1982;28:37-40; Cowan T, Pasquali M. Laboratory investigations of inborn errors of metabolism. In: Sarafoglou K, Hoffman GF, Roth KS, eds. Pediatric Endocrinology and Inborn Errors of Metabolism. 2nd ed. McGraw-Hill; 2017:1139-1158)

Gal-1-P + UDP-Glu	GALT ----------> Phosphoglucomutase	UDP-Gal + Glu-1-P
Glu-1-P + Glu-1-6 diP	----------> Glu-6-P-Dehydrogenas	Glu-1-6 diP + Glu-6-P

	e	
Glu-6-P + NADP	---------->	Ribose-5-P + CO2 + NADPH
NADPH + MTT + PMS	---------->	Blue Violet Stain

PDF Report
No

Day(s) Performed
Pre-analytical processing: Monday through Saturday
Assay performed: Twice per month, Thursday

Report Available
4 to 17 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
82664
82775

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
GALTP	Gal-1-Phos Urdyltrns Phenotype,RBC	33780-8

Result ID	Test Result Name	Result LOINC® Value
80341	Gal-1-Phos Urdyltrns Phenotype,RBC	33780-8

34524	Reviewed By	18771-6