MAYO CLINIC LABORATORIES

Test Definition: MPS1R

Endogenous Mucopolysaccharidosis Type I (IDUA [Alpha-L-Iduronidase]) Biomarker Reflex, Blood Spot

Overview

Useful For

Second-tier testing of newborns with an abnormal primary screening result for mucopolysaccharidosis type I (MPS I, decreased alpha-L-iduronidase activity) where quantitation of the glycosaminoglycans dermatan and heparan sulfate is desired in the presence of elevated endogenous MPS I biomarkers

Follow-up testing for evaluation of an abnormal newborn screening result for MPS I

This test is **not useful** a monitoring test for individuals with MPS I.

This test is **not appropriate** for carrier detection.

Reflex Tests

Test Id	Reporting Name	Available Separately	Always Performed
MPSBS	Mucopolysaccharidosis, BS	Yes	No

Genetics Test Information

This test is a second-tier assay for newborns and infants who have abnormal newborn screening results for mucopolysaccharidosis type I (MPS I) with reduced alpha-L-iduronidase activity.

Testing Algorithm

Testing begins with analysis of the mucopolysaccharidosis type I (MPS I) specific endogenous biomarker. If it is within the normal range, testing is complete. If the MPS I specific endogenous biomarker is elevated, quantification of heparan sulfate, dermatan sulfate, and keratan sulfate will be performed at an additional charge.

If the patient has abnormal newborn screening results for MPS I, timely action should be taken. Refer to the appropriate American College of Medical Genetics and Genomics Newborn Screening ACT Sheet.(1)

For more information see -Newborn Screen Follow-up for Mucopolysaccharidosis Type I Decreased Alpha-L-Iduronidase Activity

Special Instructions

- Biochemical Genetics Patient Information
- Blood Spot Collection Card-Spanish Instructions
- Newborn Screen Follow-up for Mucopolysaccharidosis Type I Decreased Alpha-L-Iduronidase Activity
- Blood Spot Collection Card-Chinese Instructions
- Blood Spot Collection Instructions

Highlights

Test Definition: MPS1R

Endogenous Mucopolysaccharidosis Type I (IDUA [Alpha-L-Iduronidase]) Biomarker Reflex, Blood Spot

This assay provides an assessment of a glycosaminoglycan (GAG) fragment that is specific to mucopolysaccharidosis type I (MPS I) with reflex to quantitative values of heparan, dermatan, and keratan sulfate when elevated.

Elevations of the MPS I specific endogenous biomarker and the GAGs heparan and dermatan sulfate are suggestive of a diagnosis of MPS I.

This assay can help differentiate true cases of MPS I from false-positive cases (such as carriers and pseudodeficiency of alpha-L-iduronidase enzyme).

Additional biochemical or molecular testing is required to confirm a diagnosis of MPS I.

Method Name
Liquid Chromatography Tandem Mass Spectrometry (LC-MS/MS)

NY State Available
Yes

Specimen

Specimen Type
Whole blood

Ordering Guidance
This test is recommended for assessment of newborns and infants with a positive newborn screen (reduced IDUA activity) for mucopolysaccharidosis type I (MPS I). This test is **not intended** to be used as a monitoring test for individuals with confirmed MPS I.

Shipping Instructions
Specimens stored at ambient temperatures for more than 13 days after collection may result in false-positive results in carrier and other unaffected individuals.

Specimen Required
Supplies: Card-Blood Spot Collection (Filter Paper) (T493)
Container/Tube:
Preferred: Blood Spot Collection Card
Acceptable: Whatman Protein Saver 903 paper, PerkinElmer 226 filter paper, Munktell filter paper, local newborn screening card, or postmortem screening card.
Specimen Volume: 2 Blood spots
Collection Instructions:
1. An alternative blood collection option for a patient older than 1 year is a fingerstick. For detailed instructions, see How to Collect Dried Blood Spot Samples.

2. Completely fill at least 2 circles on filter paper card (approximately 100 microliters blood per circle).
3. Let blood dry on the filter paper at ambient temperature in a horizontal position for a minimum of 3 hours.
4. Do not expose specimen to heat or direct sunlight.
5. Do not stack wet specimens.
6. Keep specimen dry.

Additional Information:

1. For collection instructions, see Blood Spot Collection Instructions
2. For collection instructions in Spanish, see Blood Spot Collection Card-Spanish Instructions (T777)
3. For collection instructions in Chinese, see Blood Spot Collection Card-Chinese Instructions (T800)

Forms

1. Biochemical Genetics Patient Information (T602)
2. If not ordering electronically, complete, print, and send a Biochemical Genetics Test Request (T798) with the specimen.

Specimen Minimum Volume

1 Blood spot

Reject Due To

Blood spot specimen that shows serum rings or has multiple layers/applications	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Whole blood	Refrigerated (preferred)	30 days	FILTER PAPER
	Ambient	13 days	FILTER PAPER
	Frozen	90 days	FILTER PAPER

Clinical & Interpretive

Clinical Information

Mucopolysaccharidosis type I (MPS I) is an autosomal recessive disorder caused by reduced or absent activity of the enzyme alpha-L-iduronidase due to variants in the *IDUA* gene. Deficiency of alpha-L-iduronidase can result in a wide range of phenotypes categorized into 3 syndromes: Hurler syndrome (MPS IH), Scheie syndrome (MPS IS), and Hurler-Scheie syndrome (MPS IH/S). Because these syndromes cannot be distinguished biochemically, they are also

referred to as MPS I and attenuated MPS I.

Clinical features and severity of symptoms of MPS I are variable, ranging from severe disease to an attenuated form that generally presents at a later onset with a milder clinical presentation. In general, symptoms may include coarse facies, progressive dysostosis multiplex, hepatosplenomegaly, corneal clouding, hearing loss, intellectual disabilities or learning difficulties, and cardiac valvular disease. The incidence of MPS I is approximately 1 in 100,000 live births. Treatment options include hematopoietic stem cell transplantation and enzyme replacement therapy.

Individuals with MPS I typically demonstrate elevated levels of the glycosaminoglycans (GAGs) dermatan sulfate and heparan sulfate (see MPSQU / Mucopolysaccharides Quantitative, Random, Urine; MPSBS / Mucopolysaccharides, Blood Spot), as well as elevated levels of GAG fragments known as endogenous disaccharide biomarkers that are specific to the deficiency of alpha-L-iduronidase. Reduced or absent activity of alpha L-iduronidase (see IDUAW / Alpha-L-Iduronidase, Leukocytes) can confirm a diagnosis of MPS I but may also be deficient in unaffected individuals who are carriers or with pseudodeficiency. Molecular sequence analysis of the *IDUA* gene allows for detection of disease-causing variants in affected individuals and subsequent carrier detection in relatives (IDUA / Mucopolysaccharidosis Type I, *IDUA* Gene Sequencing with Deletion/Duplication, Varies).

Reference Values

An interpretive report will be provided.

Interpretation

The measurements of mucopolysaccharidosis type I (MPS I) specific endogenous biomarker is compared to the reference value. This report is in text form only, indicating if the MPS I specific endogenous biomarker value is or is not suggestive of a biochemical diagnosis of MPS I. In any specimen where the MPS I specific endogenous biomarker value is elevated, quantitative analysis of heparan, dermatan, and keratan sulfate will be performed. Abnormal results are not sufficient to conclusively establish a diagnosis of a particular disease. To verify a preliminary diagnosis, independent biochemical (ie, in vitro enzyme assay and quantitative glycosaminoglycan measurement) or molecular genetic analyses are required, many of which are offered within Mayo Clinic Laboratories. Recommendations for additional biochemical testing and confirmatory studies (biomarker, enzyme assay, molecular analysis) are provided in the interpretative report.

Cautions

No significant cautionary statements

Clinical Reference

1. ACMG Newborn Screening ACT Sheets. Newborn Screening ACT Sheet [alpha-L-iduronidase deficiency with or without glycosaminoglycan (GAG) accumulation] Mucopolysaccharidosis Type I (MPS I). American College of Medical Genetics and Genomics; 2022. Updated November 2023. Accessed June 25, 2026. Available at www.acmg.net/PDFLibrary/MPSI-Algorithm.pdf

2. Saville JT, Herbst ZM, Gelb MH, Fuller M. Endogenous, non-reducing end glycosaminoglycan biomarkers for the mucopolysaccharidoses: Accurate diagnosis and elimination of false positive newborn screening results. Mol Gen Metab. 2023;140(3):107685

3. Herbst ZM, Hong X, Urdaneta L, et al. Endogenous, non-reducing end glycosaminoglycan biomarkers are superior to internal disaccharide glycosaminoglycan biomarkers for newborn screening of mucopolysaccharidoses and GM1 gangliosidosis. Mol Genet Metab. 2023;140(1-2):107632

4. Peck DS, Lacey JM, White AL, et al. Incorporation of second-tier biomarker testing improves the specificity of newborn screening for mucopolysaccharidosis type I. Int J Neonatal Screen. 2020;6(1):10. doi:10.3390/ijns6010010

Performance

Method Description
Sample preparation consists of extraction from dried blood spots using aqueous buffer and the addition of reagents to aid in removing the analytes from the filter paper. The resulting extracted analytes are chemically derived to aid in chromatographic separation and to increase signal intensity. A liquid/liquid extraction is preformed to remove the derived analytes from bulk matrix. The sample is then analyzed via liquid chromatography tandem mass spectrometry.(Unpublished Mayo method)

PDF Report
No

Day(s) Performed
Monday, Thursday

Report Available
3 to 6 days

Specimen Retention Time
6 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
82542

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
MPS1R	MPS I Biomarker Reflex, BS	79564-1

Result ID	Test Result Name	Result LOINC® Value
622361	Interpretation	59462-2
622362	Reviewed by	18771-6