Test Definition: PPFWE

Protoporphyrins, Fractionation, Washed Erythrocytes

Overview

Useful For

Preferred test for analysis of erythrocyte protoporphyrin fractions

Preferred test for evaluating patients with possible diagnoses of erythropoietic protoporphyria and X-linked dominant protoporphyria

Establishing a biochemical diagnosis of erythropoietic protoporphyria, or X-linked dominant protoporphyria

Testing Algorithm

This test should **not be ordered** in conjunction with PEWE / Porphyrins Evaluation, Washed Erythrocytes.

The following algorithms are available:
-Porphyria (Acute) Testing Algorithm
-Porphyria (Cutaneous) Testing Algorithm
-The Heme Biosynthetic Pathway

Special Instructions

- The Heme Biosynthetic Pathway
- Porphyria (Acute) Testing Algorithm
- Porphyria (Cutaneous) Testing Algorithm

Method Name

High-Performance Liquid Chromatography (HPLC) with Fluorescence Detection

NY State Available

Yes

Specimen

Specimen Type

Washed RBC

Ordering Guidance

This test is for assessment for protoporphyria, an erythropoietic porphyria. The preferred test for lead toxicity in children is blood lead. For more information see PBDV / Lead, Venous with Demographics, Blood or PBDC / Lead, Capillary, with Demographics, Blood. The preferred screening test for suspicion of a hepatic porphyria is urine porphyrins. For more information see PQNRU / Porphyrins, Quantitative, Random, Urine.

Necessary Information

1. Volume of packed cells and total volume of specimen (red cells + saline) are required and must be sent with specimen.

2. Include a list of medications the patient is currently taking.

Specimen Required

All porphyrin tests on erythrocytes can be performed on 1 tube.

Patient Preparation: Patient **must not** consume any alcohol for 24 hours before specimen collection.
Collection Container/Tube:
Preferred: Green top (sodium heparin)
Acceptable: Dark blue top (metal free heparin), green top (lithium heparin), or lavender top (EDTA)
Submission Container/Tube: Plastic vial
Specimen Volume: Entire washed erythrocyte suspension
Collection Instructions: Collect and process whole blood specimen as follows:
1. Transfer entire specimen to a 12-mL graduated centrifuge tube.
2. Centrifuge specimen at 4 degrees C for 10 minutes at 2000 rpm.
3. Record volume of packed cells and the total volume of the specimen.
4. Discard supernatant plasma.
5. Wash packed erythrocytes 2 times by resuspension of at least an equal amount of cold 0.9% saline, mix, and centrifuge for 5 minutes at 2000 rpm, discarding supernatant after each washing.
6. Resuspend packed cells to the original total volume with 0.9% saline. Invert specimen gently to mix.
7. Transfer washed erythrocytes into a plastic vial and freeze.

Forms

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

Specimen Minimum Volume

1 mL of washed and resuspended erythrocytes

Reject Due To

Cell suspension not available	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Washed RBC	Frozen (preferred)	14 days	
	Refrigerated	14 days	

Clinical & Interpretive

Clinical Information

The porphyrias are a group of inherited disorders resulting from enzyme defects in the heme biosynthetic pathway. Depending on the specific enzyme involved, various porphyrins and their precursors accumulate in different specimen types. The patterns of porphyrin accumulation in erythrocytes and plasma, and excretion of the heme precursors in urine and feces allow for the detection and differentiation of the porphyrias.

Testing protoporphyrin fractions is most informative for patients with a clinical suspicion of erythropoietic protoporphyria (EPP) or X-linked dominant protoporphyria (XLDPP). Clinical presentation of EPP and XLDPP is identical with onset of symptoms typically occurring in childhood. Cutaneous photosensitivity in sun-exposed areas of the skin generally worsens in the spring and summer months. Common symptoms may include itching, edema, erythema, stinging or burning sensations, and occasionally scarring of the skin in sun-exposed areas. Although genetic in nature, environmental factors exacerbate symptoms, significantly impacting the severity and course of disease.

Erythropoietic protoporphyria is caused by diminished ferrochelatase resulting in significantly increased free protoporphyrin levels in erythrocytes, plasma, and feces.

X-linked dominant protoporphyria is caused by gain-of-function variants in the C-terminal end of *ALAS2* gene and results in elevated erythrocyte levels of free and zinc-complexed protoporphyrin, and total protoporphyrin in plasma and feces.

Other possible causes of elevated erythrocyte zinc-complexed protoporphyrin may include:
-Iron-deficiency anemia, the most common cause
-Chronic intoxication by heavy metals (primarily lead) or various organic chemicals
-Congenital erythropoietic porphyria, a rare autosomal recessive porphyria caused by deficient uroporphyrinogen III synthase
-Hepatoerythropoietic porphyria, a rare autosomal recessive porphyria caused by deficient uroporphyrinogen decarboxylase

Typically, the workup of patients with a suspected porphyria is most effective when following a stepwise approach. See Porphyria (Acute) Testing Algorithm and Porphyria (Cutaneous) Testing Algorithm or call 800-533-1710 to discuss testing strategies.

There are 2 test options:
-PPFE / Protoporphyrins, Fractionation, Whole Blood
-PPFWE / Protoporphyrins, Fractionation, Washed Erythrocytes
The whole blood option is easiest for clients but requires that the specimen arrive at Mayo Clinic Laboratories within 7 days of collection. When this cannot be ensured, washed frozen erythrocytes, which are stable for 14 days, should be submitted.

Reference Values

FREE PROTOPORPHYRIN
<20 mcg/dL

ZINC-COMPLEXED PROTOPORPHYRIN
<60 mcg/dL

Interpretation

Abnormal results are reported with a detailed interpretation that may include an overview of the results and their significance, a correlation to available clinical information provided with the specimen, differential diagnosis, and recommendations for additional testing when indicated and available.

Cautions

Patients must abstain from alcohol for at least 24 hours prior to specimen collection. Alcohol suppresses enzyme activity potentially leading to false-positive results.

Clinical Reference

1. Tortorelli S, Kloke K, Raymond K. Disorders of porphyrin metabolism. In: Dietzen DJ, Bennett MJ, Wong EDD, eds. Biochemical and Molecular Basis of Pediatric Disease. 4th ed. AACC Press; 2010:307-324
2. Phillips JD: Heme biosynthesis and the porphyrias. Mol Genet Metab. 2019;128(3):164-177. doi:10.1016/j.ymgme.2019.04.008
3. Anderson KE, Sassa S, Bishop DF, Desnick RJ. Disorders of heme biosynthesis: X-Linked sideroblastic anemia and the porphyrias. In: Valle DL, Antonarakis S, Ballabio A, Beaudet AL, Mitchell GA, eds. The Online Metabolic and Molecular Bases of Inherited Disease. McGraw-Hill; 2019. Accessed September 6, 2024. Available at https://ommbid.mhmedical.com/content.aspx?sectionid=225540906&bookid=2709
4. Whatley SD, Ducamp S, Gouya L, et al. C-terminal in the *ALAS2* gene lead to gain of function and cause X-linked dominant protoporphyria without anemia or iron overload. Am J Hum Genet. 2008;83(3):408-414

Performance

Method Description

Extraction followed by fractionation by high-performance liquid chromatography. Zinc protoporphyrin and free protoporphyrin are separately quantitated.(Smith RM, Doran D, Mazur M, Bush B. High-performance liquid chromatographic determination of protoporphyrin and zinc protoporphyrin in blood. J Chromatogr 1980;181[3-4]:319-327; Gou EE, Balwani M, Bissell DM, et al. Pitfalls in erythrocyte protoporphyrin measurement for diagnosis and monitoring of protoporphyrias. Clin Chem. 2015;61[12]:1453-6. doi:10.1373/clinchem.2015.245456)

PDF Report

No

Day(s) Performed

Monday through Friday

Report Available

3 to 5 days

Specimen Retention Time

14 days

Test Definition: PPFWE

Protoporphyrins, Fractionation, Washed Erythrocytes

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
PPFWE	Protoporphyrins, Fractionation, RBC	94490-0

Result ID	Test Result Name	Result LOINC® Value
31932	Zinc-Complexed Protoporphyrin	2895-1
31933	Free Protoporphyrin	94491-8
INTP6	Interpretation	59462-2
BG571	Total cell suspension	94496-7
BG572	Packed cell volume	94497-5