Test Definition: PKUSC

Phenylalanine and Tyrosine, Self-Collect, Blood Spot

Overview

Useful For

Monitoring effectiveness of therapy in patients with hyperphenylalaninemia in a patient-collected specimen

This test is **not sufficient** for follow-up for abnormal newborn screening results or for establishing a diagnosis of a specific cause of hyperphenylalaninemia.

Genetics Test Information

This test is intended for monitoring effectiveness of therapy for patients with hyperphenylalaninemia.

This test **does not provide** sufficient follow-up for abnormal newborn screening results because other causes of hyperphenylalaninemia (eg, tetrahydrobiopterin deficiency) cannot be excluded by this test alone.

Special Instructions

- Blood Spot Collection Instructions-Fingerstick
- Blood Spot Collection Instructions-Fingerstick-Spanish

Highlights

Blood spot specimens for this test are self-collected by the patient to send directly to Mayo Clinic Laboratories via supplied collection kit. For more information, see Specimen Required.

Method Name

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

NY State Available

Yes

Specimen

Specimen Type

Whole blood

Ordering Guidance

For follow-up of an abnormal newborn screen for potential phenylketonuria, order PKU / Phenylalanine and Tyrosine, Plasma

Necessary Information

1. Patient's age is required.

2. Patient's street address, city, state, ZIP (postal) code, country, and home phone are required (post-office [PO] boxes

are not acceptable delivery locations).

Specimen Required

Supplies: Blood Spot Collection-Self Collect (T858)
Container/Tube: Blood Spot Self Collection Card
Specimen Volume: 2 Blood spots
Additional Information:
1. Order test each time the patient is to collect a dried blood specimen at home and mail the specimen directly to Mayo Clinic Laboratories.
2. Order should be placed a minimum of 3 days prior to desired date of collection.
3. Enter patient's address information for each order created, including street address (**post office [PO] boxes are not acceptable delivery locations**), city, state abbreviation, zip code, country, and home phone number.
4. For each order, the Blood Spot Collection-Self Collect kit will be mailed directly to the patient for self-collection (**delivery to a PO box will not occur**).
5. For more information on how to collect blood spots, see the following:
-How to Collect Dried Blood Spot Samples via fingerstick.
-Blood Spot Collection Instructions-Fingerstick
-Blood Spot Collection Instructions-Fingerstick-Spanish

Forms

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	Reject
Insufficient specimen	Reject
Unapproved filter papers	Reject

Specimen Stability Information

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

Clinical & Interpretive

Clinical Information

Phenylketonuria (PKU) is the most frequent inherited disorder of amino acid metabolism (occurring in about 1:10,000-1:15,000 births) and was the first successfully treated inborn error of metabolism. It is inherited in an autosomal recessive manner and is caused by a defect in the enzyme phenylalanine hydroxylase (PAH), which converts the essential amino acid phenylalanine to tyrosine. Deficiency of PAH results in decreased levels of tyrosine and an accumulation of phenylalanine in blood and tissues. Untreated PKU leads to severe brain damage with intellectual impairment, behavior abnormalities, seizures, and spasticity. The level of enzyme activity differentiates classic PKU (PAH activity <1%) from other milder forms; however, all are characterized by increased levels of phenylalanine (hyperphenylalaninemia). Treatment includes the early introduction of a diet low in phenylalanine. Some patients may also benefit from adjuvant tetrahydrobiopterin (BH4) supplementation (a cofactor for PAH) or enzyme substitution therapy.

BH4 is a cofactor of not only PAH but also of the tyrosine and tryptophan hydroxylases. Approximately 2% of patients with hyperphenylalaninemia have a deficiency of BH4, which causes a secondary deficit of the neurotransmitters dopamine and serotonin. There are 4 autosomal-recessive disorders associated with BH4 deficiency plus hyperphenylalaninemia; guanosine triphosphate cyclohydrolase deficiency, 6-pyruvoyl tetrahydropterin synthase deficiency, dihydropteridine reductase deficiency, and pterin-4 alpha carbinolamine dehydratase (PCD) deficiency. This group of disorders, except for PCD, is characterized by progressive dystonia, truncal hypotonia, extremity hypertonia, seizures, and intellectual disability though milder presentations exist. PCD has no symptoms other than transient alterations in tone. Treatment may include administration of BH4, L-dopa (and carbidopa) 5-hydroxytryptophan supplements, and a low phenylalanine diet.

Tyrosine is a nonessential amino acid that is derived from dietary sources, the hydroxylation of phenylalanine, or protein breakdown. Primary (PKU) and secondary (defects of BH4 metabolism) hyperphenylalaninemia can cause abnormally low levels of tyrosine. Measurement of the phenylalanine:tyrosine ratio is helpful in monitoring appropriate dietary intake.

Reference Values

PHENYLALANINE:
27-107 nmol/mL

TYROSINE
<4 weeks: 40-280 nmol/mL
> or =4 weeks: 25-150 nmol/mL

Interpretation

The quantitative results of phenylalanine and tyrosine with age-dependent reference values are reported without added interpretation. When applicable, reports of abnormal results may contain an interpretation based on available clinical information.

A phenylalanine:tyrosine ratio higher than 3 is considered abnormal.

Cautions
No significant cautionary statements

Clinical Reference
1. Mitchell GA, Grompe M, Lambert M, Tanguay RM. Hypertyrosinemia. 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 December 26, 2023. Available at https://ommbid.mhmedical.com/content.aspx?bookid=2709&sectionid=225082825
2. Donlon J, Sarkissian C, Levy H, Scriver CR, Hyperphenylalaninemia. Phenylalanine hydroxylase deficiency. 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 December 26, 2023. Available at https://ommbid.mhmedical.com/content.aspx?bookid=2709&sectionid=225081923
3. Regier DS, Greene CL. Phenylalanine hydroxylase deficiency. In: Adam MP, Ardinger HH, Pagon RA, et al, eds. GeneReviews [Internet]. University of Washington, Seattle; 2000. Updated January 5, 2017. Accessed December 26, 2023. Available at www.ncbi.nlm.nih.gov/books/NBK1504/

Performance

Method Description
A 3-mm disk is punched out of the dried blood spot onto a 96-well plate. The amino acids are extracted by the addition of acetonitrile and known concentrations of isotopically labeled amino acids as internal standards. The extract is moved to another 96-well plate, dried under a stream of nitrogen, and derivatized by the addition of n-butanol hydrochloric acid. Analytes are measured by liquid chromatography tandem mass spectrometry. The concentrations of the phenylalanine and tyrosine are established by computerized comparison of ion intensities of these analytes to that of the respective internal standards.(Unpublished Mayo method)

PDF Report
No

Day(s) Performed
Monday through Friday

Report Available
3 to 5 days

Specimen Retention Time
1 year

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

0382U

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
PKUSC	Phenylalanine and Tyrosine, SC, BS	79621-9

Result ID	Test Result Name	Result LOINC® Value
610515	Tyrosine, BS	35571-9
610516	Phenylalanine, BS	29573-3
610514	Reviewed By	18771-6
BG735	Patient Street Address (No PO Box)	56799-0
BG736	Patient City	68997-6
BG737	Patient State	46499-0
BG738	Patient Zip Code	45401-7
BG742	Patient Country	77983-5
BG739	Patient Home Phone	42077-8