MAYO CLINIC LABORATORIES

Test Definition: AAUCD

Amino Acids, Urea Cycle Disorders Panel, Plasma

Overview

Useful For
Differential diagnosis and follow-up of patients with urea cycle disorders

Highlights
Urea cycle disorders (UCD) are a group of inherited disorders of nitrogen detoxification that result from defects in any of the enzymes involved in the urea cycle.

Disruption of the urea cycle can result in the accumulation of ammonia which is toxic to the nervous system.

Plasma amino acid analysis can be used to aid in the diagnosis of a UCD as well as for follow-up of a known patient.

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

NY State Available
Yes

Specimen

Specimen Type
Plasma

Necessary Information
1. Patient's age is required.
2. Include family history, clinical condition (asymptomatic or acute episode), diet, and drug therapy information.

Specimen Required
Patient Preparation: Fasting (overnight preferred, 4 hours minimum). Infants should be drawn just before next feeding (2-3 hours without total parenteral nutrition if possible).
Collection Container/Tube:
Preferred: Green top (sodium heparin)
Acceptable: Lavender top (EDTA) or green top (lithium heparin)
Submission Container/Tube: Plastic vial
Specimen Volume: 0.5 mL
Collection Instructions:
1. Centrifuge within 4 hours if specimen is stored at refrigerated temperature and aliquot plasma.
2. Send plasma frozen.

Forms

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

Specimen Minimum Volume

0.25 mL

Reject Due To

Gross hemolysis	OK
Gross lipemia	OK
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Plasma	Frozen (preferred)	14 days	

Clinical & Interpretive

Clinical Information

Urea cycle disorders (UCD) are a group of inherited disorders of nitrogen detoxification that result when any of the enzymes in the urea cycle (carbamoylphosphate synthetase I [CPS I], ornithine transcarbamylase [OTC], argininosuccinic acid synthetase, argininosuccinic acid lyase, arginase, or the cofactor producer, N-acetyl glutamate synthetase [NAGS]), have deficient or reduced activity. The role of the urea cycle is to metabolize and clear waste nitrogen, and defects in any of the steps of the pathway can result in an accumulation of ammonia, which can be toxic to the nervous system. The urea cycle is also responsible for endogenous production of the amino acids citrulline, ornithine, and arginine. Infants with a complete urea cycle enzyme deficiency typically appear normal at birth but present in the neonatal period as ammonia levels rise with lethargy, seizures, hyper- or hypoventilation, and ultimately coma or death. Individuals with partial enzyme deficiency may present later in life, typically following an acute illness or other stressors. Symptoms may be less severe and may present with episodes of psychosis, lethargy, cyclical vomiting, and behavioral abnormalities. Patients with impaired ornithine metabolism due to ornithine aminotransferase deficiency may present with childhood onset myopia progressing to vision loss in the 4th to 6th decades of life. Patients may or may not have accompanying hyperammonemia but display marked elevations in plasma ornithine.

All of the UCD are inherited as autosomal recessive disorders, with the exception of OTC deficiency, which is X-linked. UCD may be suspected with elevated ammonia, normal anion gap, and a normal glucose. Plasma amino acids can be used to aid in the diagnosis of UCD and may aid in monitoring treatment effectiveness. Measurement of urinary orotic acid, enzyme activity (CPS I, OTC, or NAGS), and molecular genetic testing can help to distinguish the conditions and allows for diagnostic confirmation.

Acute treatment for UCD consists of dialysis and administration of nitrogen scavenger drugs to reduce ammonia concentration. Chronic management typically involves restriction of dietary protein with essential amino acid supplementation. More recently, orthotopic liver transplantation has been used with success in treating some patients.

Reference Values

GLUTAMINE
< or =23 months: 316-1020 nmol/mL
2-17 years: 329-976 nmol/mL
> or =18 years: 371-957 nmol/mL

ORNITHINE
< or =23 months: 20-130 nmol/mL
2-17 years: 22-97 nmol/mL
> or =18 years: 38-130 nmol/mL

CITRULLINE
< or =23 months: 9-38 nmol/mL
2-17 years: 11-45 nmol/mL
> or =18 years: 17-46 nmol/mL

ARGININE
< or =23 months: 29-134 nmol/mL
2-17 years: 31-132 nmol/mL
> or =18 years: 32-120 nmol/mL

ARGININOSUCCINIC ACID
<2 nmol/mL
Reference value applies to all ages.

Interpretation

The quantitative results of glutamine, ornithine, citrulline, arginine, and argininosuccinic acid with age-dependent reference values are reported without added interpretation. When applicable, reports of abnormal results may contain an interpretation based on available clinical interpretation.

Cautions

Reference values are for fasting patients.

Clinical Reference

1. Brusilow SW, Horwich AL. Urea cycle enzymes. 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 April 18, 2022. https://ommbid.mhmedical.com/content.aspx?bookid=2709&sectionid=225084071 2. Haberle J, Burlina A, Chakrapani A, et al: Suggested guidelines for diagnosis and management of urea cycle disorders: First revision. OJ Inherit Metab Dis. 2019 Nov;42(6):1192-1230. doi: 10.1002/jimd.12100
3. Valle D, Simell O. The Hyperornithinemias. 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 April 18, 2022. https://ommbid.mhmedical.com/content.aspx?bookid=2709&sectionid=225083672
4. Foshci FG, Morelli MC, Savini S, et al: Urea cycle disorders: A case report of a successful liver transplant and a literature review. World J Gastroenterol. 2015 Apr 7;21(13):4063-4068. doi: 10.3748/wjg.v21.i13.4063

5. Ah Mew N, Simpson KL, Gropman AL, et al: Urea Cycle Disorders Overview. In: Adam MP, Ardinger HH, Pagon RA, et al. GeneReviews[Internet]. University of Washington, Seattle; 2003. Updated June 22, 2017. Accessed May 28, 2019. Available at https://www.ncbi.nlm.nih.gov/books/NBK1217/

Performance

Method Description

Quantitative analysis of amino acids is performed by liquid chromatography-tandem mass spectrometry (LC-MS/MS) by labeling amino acids present in plasma, urine, and spinal fluid with aTRAQ Reagent 121. Samples are dried and reconstituted with aTRAQ Reagent 113-labeled Standard Mix. Amino acids are separated and detected by LC-MS/MS. The concentrations of amino acids are established by comparison of their ion intensity (121-labeled amino acids) to that of their respective internal standards (113-labeled amino acids).(Unpublished Mayo method)

PDF Report

No

Day(s) Performed

Monday through Friday

Report Available

3 to 5 days

Specimen Retention Time

2 weeks

Performing Laboratory Location

Rochester

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 Regional Manager. 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. This test has not been cleared or approved by the US Food and Drug Administration.

CPT Code Information

82136

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
AAUCD	Amino Acid, Urea Cycle Panel, P	100368-0

Result ID	Test Result Name	Result LOINC® Value
32440	Glutamine	20643-3
32441	Citrulline	20640-9
32442	Argininosuccinic Acid	32227-1
32443	Arginine	20637-5
32444	Ornithine	20652-4
32445	Interpretation (AAUCD)	49247-0