

## Overview

### Useful For

Diagnosis of cystinuria

### Genetics Test Information

This test provides a biochemical diagnosis of cystinuria through the measurement of cystine, lysine, ornithine, and arginine.

### Special Instructions

- [Urine Preservatives-Collection and Transportation for 24-Hour Urine Specimens](#)

### Method Name

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

### NY State Available

Yes

## Specimen

### Specimen Type

Urine

### Necessary Information

1. **24-Hour volume is required.**
2. **Patient's age is required.**
3. Include family history, clinical condition (asymptomatic or acute episode), diet, and drug therapy information.

### Specimen Required

**Supplies:** Urine Tubes, 10 mL (T068)

**Specimen Volume:** 5 mL

#### Collection Instructions:

1. Collect before intravenous pyelogram.
2. Collect urine for 24 hours.
3. Add 20 mL of toluene as preservative **at start of collection**. If preservative is not available, refrigerate during collection.
4. Mix well before taking 5-mL aliquot.

**Additional Information:** See [Urine Preservatives-Collection and Transportation for 24-Hour Urine Specimens](#) for multiple collections.

## Forms

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

### Urine Preservative Collection Options

**Note:** The addition of preservative must occur prior to beginning the collection. If preservative is not available, refrigerate during and after collection.

|                      |           |
|----------------------|-----------|
| Ambient              | No        |
| Refrigerate          | OK        |
| Frozen               | OK        |
| 50% Acetic Acid      | No        |
| Boric Acid           | No        |
| Diazolidinyl Urea    | OK        |
| 6M Hydrochloric Acid | No        |
| 6M Nitric Acid       | No        |
| Sodium Carbonate     | No        |
| Thymol               | No        |
| Toluene              | Preferred |

### Specimen Minimum Volume

1 mL

### Reject Due To

All specimens will be evaluated at Mayo Clinic Laboratories for test suitability.

### Specimen Stability Information

| Specimen Type | Temperature        | Time    | Special Container |
|---------------|--------------------|---------|-------------------|
| Urine         | Frozen (preferred) | 70 days |                   |
|               | Refrigerated       | 14 days |                   |

## Clinical & Interpretive

### Clinical Information

Cystinuria is an inborn error of metabolism resulting from poor absorption and reabsorption of the amino acid cystine in the intestines and kidneys. This leads to an accumulation of poorly soluble cystine in the urine and results in the production of kidney stones (urolithiasis). Symptoms may include acute episodes of abdominal or lower back pain and the presence of blood in the urine (hematuria). Recurrent episodes of kidney stones may result in frequent urinary tract infections, which may ultimately result in renal insufficiency. The combined incidence of cystinuria has been estimated to be 1 in 7000.

Cystinuria is an autosomal recessive disease, but some heterozygous carriers have an autosomal dominant, incomplete penetrance appearance with elevated, but typically nondisease-causing, urinary cystine excretion. Cystinuria is caused

by variants in genes, *SLC3A1* on chromosome 2p and *SLC7A9* on chromosome 19q. Initially, the disease was classified into subtypes I, II, and III (type II and III are also referred as nontype-I) based on the amount of urinary cystine excreted in heterozygous parental specimens. A new classification system has been proposed to distinguish the various forms of cystinuria: type A, due to variants in the *SLC3A1* gene; type B, due to variants in the *SLC7A9* gene; and type AB, due to 1 variant in each *SLC3A1* and *SLC7A9* gene.

## Reference Values

### CYSTINE

3-15 years: 11-53 mcmol/24 h

> or =16 years: 28-115 mcmol/24 h

### LYSINE

3-15 years: 19-140 mcmol/24 h

> or =16 years: 32-290 mcmol/24 h

### ORNITHINE

3-15 years: 3-16 mcmol/24 h

> or =16 years: 5-70 mcmol/24 h

### ARGININE

3-15 years: 10-25 mcmol/24 h

> or =16 years: 13-64 mcmol/24 h

### Conversion Formulas:

Result in mcmol/24 hours x 0.24=result in mg/24 h

Result in mg/24 hours x 4.17=result in mcmol/24 h

## Interpretation

Individuals who are homozygous or compound heterozygous for cystinuria excrete large amounts of cystine in urine, but the amount varies markedly. Urinary excretion of other dibasic amino acids (arginine, lysine, and ornithine) is also typically elevated. Plasma concentrations are generally normal or slightly decreased.

Individuals who are homozygous and heterozygous for nontype I cystinuria can be distinguished by the pattern of urinary amino acids excretion: homozygous individuals secrete large amounts of cystine and all 3 dibasic amino acids, whereas heterozygous individuals secrete more lysine and cystine than arginine and ornithine.

## Cautions

No significant cautionary statements

## Clinical Reference

- 1.Saravakos P, Kokkinou V, Giannatos E. Cystinuria: current diagnosis and management. *Urology*. 2014;83(4):693-699
- 2.Servais A, Thomas K, Strologo LD, et al. Cystinuria: clinical practice recommendation. *Kidney Int*. 2021;99(1):48-58
- 3.Palacin M, Goodyer P, Nunes V, Gasparini P. Cystinuria. 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 March 08, 2023. Available at <https://ommbid.mhmedical.com/content.aspx?bookid=2709&sectionid=225555540>

## Performance

### Method Description

Quantitative analysis of the amino acids cystine, lysine, arginine, and ornithine is performed by liquid chromatography tandem mass spectrometry (LC-MS/MS) by labeling amino acids present in urine 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 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. 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 |
|---------|---------------------------------|--------------------|
| CYSQN   | Cystinuria Profile, QN, 24 hour | 90785-7            |

| Result ID | Test Result Name    | Result LOINC® Value |
|-----------|---------------------|---------------------|
| TM38      | Collection Duration | 13362-9             |
| VL36      | Urine Volume        | 3167-4              |
| 3583      | Cystine             | 13966-7             |
| 3589      | Lysine              | 25464-9             |
| 3590      | Ornithine           | 25491-2             |
| 3591      | Arginine            | 25322-9             |
| 50447     | Reviewed By         | 18771-6             |