

## Overview

### Useful For

Investigating possible disorders of mitochondrial metabolism, when used in conjunction with cerebrospinal fluid lactate, collected at the same time, to determine the lactate-to-pyruvate (L:P) ratio

Evaluating patients with neurologic dysfunction and normal blood L:P ratios

### Genetics Test Information

The cerebrospinal fluid lactate:pyruvate (L:P) ratio is considered a helpful (not diagnostic) tool in the evaluation of patients with possible disorders of mitochondrial metabolism, especially in patients with neurologic dysfunction and normal blood L:P ratios. Pyruvic acid levels alone have little clinical utility.

### Testing Algorithm

For information see: [Epilepsy: Unexplained Refractory and/or Familial Testing Algorithm](#)

### Special Instructions

- [Biochemical Genetics Patient Information](#)
- [Epilepsy: Unexplained Refractory and/or Familial Testing Algorithm](#)

### Method Name

Spectrophotometry (SP)

### NY State Available

Yes

## Specimen

### Specimen Type

CSF

### Additional Testing Requirements

This test does not calculate the lactate:pyruvate ratio. To obtain this information, both this test **and** LASF1 / Lactic Acid, Spinal Fluid must be ordered. The ratio can be calculated from the results obtained from these tests.

### Specimen Required

**Specimen Type:** Spinal fluid

**Container/Tube:** Sterile vial

**Specimen Volume:** 0.6 mL

**Collection Instructions:** Send specimen from vial 4.

### Forms

- [Biochemical Genetics Patient Information \(T602\)](#)
- [If not ordering electronically, complete, print, and send a Biochemical Genetics Test Request \(T798\)](#) with the specimen.

**Specimen Minimum Volume**

0.5 mL

**Reject Due To**

|                 |        |
|-----------------|--------|
| Gross hemolysis | Reject |
|-----------------|--------|

**Specimen Stability Information**

| Specimen Type | Temperature              | Time    | Special Container |
|---------------|--------------------------|---------|-------------------|
| CSF           | Refrigerated (preferred) | 7 days  |                   |
|               | Ambient                  | 7 days  |                   |
|               | Frozen                   | 14 days |                   |

**Clinical & Interpretive****Clinical Information**

Pyruvic acid, an intermediate metabolite, plays an important role in linking carbohydrate and amino acid metabolism to the tricarboxylic acid cycle, the fatty acid beta-oxidation pathway, and the mitochondrial respiratory chain complex. Though pyruvate is not diagnostic in itself, analysis with lactate has diagnostic value as many inborn errors of metabolism present with laboratory findings that include lactic acidosis and/or a high lactate:pyruvate (L:P) ratio.

The L:P ratio is elevated in several, but not all, mitochondrial respiratory chain disorders. Mitochondrial disorders vary widely in presentation and age of onset. Many mitochondrial disorders have neurologic and myopathic features and may involve multiple organ systems. Determination of lactate, pyruvate, and the L:P ratio in cerebrospinal fluid is helpful in directing attention toward a possible mitochondrial disorder in cases with predominantly neurologic dysfunction and normal blood lactate levels.

A low L:P ratio is observed in inherited disorders of pyruvate metabolism including pyruvate dehydrogenase complex (PDHC) deficiency. Clinical presentation of PDHC deficiency can range from fatal congenital lactic acidosis to relatively mild ataxia or neuropathy. The most common features in infants and children with PDHC deficiency are delayed development and hypotonia. Seizures and ataxia are also frequent features. Other manifestations can include congenital brain malformations, degenerative changes including Leigh disease, and facial dysmorphism.

**Reference Values**

0.06-0.19 mmol/L

**Interpretation**

An elevated lactate-to-pyruvate (L:P) ratio may indicate inherited disorders of the respiratory chain complex, tricarboxylic acid cycle disorders and pyruvate carboxylase deficiency. Respiratory chain defects usually result in L:P

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ratios above 20.

A low L:P ratio (disproportionately elevated pyruvic acid) may indicate an inherited disorder of pyruvate metabolism. Defects of the pyruvate dehydrogenase complex result in L:P ratios below 10.

The L:P ratio is characteristically normal in other patients. An artifactually high ratio can be found in acutely ill patients.

### Cautions

Correct specimen collection and handling is crucial to achieve reliable results.

Pyruvic acid levels alone have little clinical utility. Abnormal concentrations of pyruvic acid and lactate-to-pyruvate (L:P) ratios are not diagnostic for a particular disorder but must be interpreted in the context of the patient's clinical presentation and other laboratory studies.

For the L:P ratio, both analytes should be determined using the same specimen.

When comparing blood and cerebrospinal fluid (CSF) L:P ratios, blood and CSF specimens should be collected at the same time.

### Clinical Reference

1. Munnich A, Rotig A, Cormier-Daire V, Rustin P. Clinical presentation of Respiratory Chain 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 January 14, 2025. Available at <http://ommbid.mhmedical.com/content.aspx?bookid=2709&sectionid=225086827>
2. Robinson BH: Lactic acidemia. Disorders of pyruvate carboxylase and pyruvate dehydrogenase. 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 January 14, 2025. Available at <http://ommbid.mhmedical.com/content.aspx?bookid=2709&sectionid=225087140>
3. Shoffner JM. Oxidative phosphorylation diseases. In: Valle DL, Antonarakis S, Ballabio A, Beaudet AL, Mitchell GA, eds. *Online Metabolic and Molecular Bases of Inherited Disease*. McGraw-Hill. Accessed January 14, 2025. Available at <http://ommbid.mhmedical.com/content.aspx?bookid=2709&sectionid=225088339>
4. Parikh S, Goldstein A, Koenig MK, et al. Diagnosis and management of mitochondrial disease: a consensus statement from the Mitochondrial Medicine Society. *Genet Med*. 2015;17(9):689-701. doi:10.1038/gim.2014.177

## Performance

### Method Description

Pyruvate, in the presence of excess nicotinamide adenine dinucleotide, hydrogen ions, and lactic dehydrogenase, is reduced to lactate. The reaction is stoichiometric; the decrease in absorbance at 340 nm is directly proportional to the concentration of pyruvate. (Huckabee WE. Relationships of pyruvate and lactate during anaerobic metabolism. I. Effects of infusion of pyruvate or glucose and of hyperventilation. *J Clin Invest*. 1958;37[2]:244-254; Benoist JF, Alberti C, Leclercq S, et al. Cerebrospinal fluid lactate and pyruvate concentrations and their ratio in children: age-related reference intervals. *Clin Chem*. 2003;49[3]:487-494; Cowan T, Pasquali M. Laboratory investigations of inborn errors of metabolism. In: Sarafoglou K, Hoffman GF, Roth KS, eds. *Pediatric Endocrinology and Inborn Errors of Metabolism*. 2nd

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ed. McGraw-Hill; 2017:1139-1158)

**PDF Report**

No

**Day(s) Performed**

Monday, Thursday

**Report Available**

2 to 5 days

**Specimen Retention Time**

2 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**

84210

**LOINC® Information**

| Test ID | Test Order Name   | Order LOINC® Value |
|---------|-------------------|--------------------|
| PYRC    | Pyruvic Acid, CSF | 14122-6            |

| Result ID | Test Result Name  | Result LOINC® Value |
|-----------|-------------------|---------------------|
| 83356     | Pyruvic Acid, CSF | 14122-6             |