

## Overview

### Useful For

Evaluation of patients with abnormal newborn screens showing elevations of iso-/butyrylcarnitine to aid in the differential diagnosis of short-chain acyl-CoA dehydrogenase and isobutyryl-CoA dehydrogenase deficiencies

### Genetics Test Information

Elevated iso-/butyrylcarnitine (C4) in plasma or newborn screening blood spots is due to either short chain acyl-CoA dehydrogenase (SCAD) deficiency or isobutyryl-CoA dehydrogenase (IBD) deficiency.

Urine C4 results can distinguish between SCAD deficiency, which results in normal C4 in urine, and IBD deficiency, which results in elevated C4 in urine.

### Method Name

Flow Injection Analysis-Tandem Mass Spectrometry (FIA-MS/MS)

### NY State Available

Yes

## Specimen

### Specimen Type

Urine

### Ordering Guidance

This second-tier test is used specifically to evaluate a newborn screening elevation of iso-/butyrylcarnitine and **must not** be ordered with either C5OHU / C5-OH Acylcarnitine, Quantitative, Random, Urine or C5DCU / C5-DC Acylcarnitine, Quantitative, Random, Urine.

For general screening for metabolic disorders, see OAU / Organic Acids Screen, Random, Urine; ACRN / Acylcarnitines, Quantitative, Plasma; and AAQP / Amino Acids, Quantitative, Plasma.

### Necessary Information

Patient's age, family history, clinical condition (asymptomatic or acute episode), diet, and drug therapy information is requested but not required.

### Specimen Required

**Patient Preparation:** If clinically feasible, discontinue L-carnitine supplementation at least 72 hours before specimen collection.

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

**Collection Container/Tube:** Clean, plastic urine collection container

**Submission Container/Tube:** Plastic, 10 mL urine tube

**Specimen Volume:** 5 mL**Collection Instructions:**

1. Collect a random urine specimen.
2. Freeze specimen immediately.

**Forms**

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

**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)	7 days	
	Refrigerated	24 hours	

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

An isolated elevation of iso-/butyrylcarnitine (C4) in plasma or newborn screening blood spots is related to a diagnosis of either short chain acyl-CoA dehydrogenase (SCAD) deficiency or isobutyryl-CoA dehydrogenase (IBD) deficiency.

Diagnostic testing by acylcarnitine analysis, including the evaluation of C4 excretion in urine, is necessary to differentiate the 2 clinical entities.(1) Patients with IBD deficiency excrete an abnormal amount of C4 acylcarnitine in urine, whereas patients with SCAD deficiency can have a normal excretion of this metabolite.

**Reference Values**

<3.00 millimoles/mole creatinine

**Interpretation**

Almost all patients with isobutyryl-CoA dehydrogenase deficiency excrete an abnormal amount of iso-/butyrylcarnitine (C4) in their urine. Some, but not all, affected individuals also excrete elevated levels of isobutyrylglycine. Conversely, patients with short-chain acyl-CoA dehydrogenase deficiency can have a normal excretion of C4.

**Cautions**

The results of urine acylcarnitines are typically not informative when the patient is receiving L-carnitine supplements.

**Clinical Reference**

1. Miller MJ, Cusmano-Ozog K, Oglesbee D, Young S. ACMG Laboratory Quality Assurance Committee: Laboratory analysis of acylcarnitines, 2020 update: a technical standard of the American College of Medical Genetics and Genomics (ACMG). *Genet Med.* 2021;23(2):249-258
2. Oglesbee D, Vockley J, Ensenauer RE, et al. Ten cases of isobutyryl-CoA dehydrogenase (IBDH) deficiency detected by

newborn screening. *J Inherit Metab Dis.* 2005;28(Suppl 1):13. doi:10.1007/s10545-004-0001-x

3. Oglesbee D, He M, Majumder N, et al. Development of a newborn screening follow-up algorithm for the diagnosis of isobutyryl-CoA dehydrogenase deficiency. *Genet Med.* 2007;9(2):108-116

## Performance

### Method Description

Acylcarnitines, including iso-butyrylcarnitine, are determined in urine by flow injection analysis tandem mass spectrometry using acetyl-d3-carnitine, propionyl-d3-carnitine, butyryl-d3-carnitine, octanoyl-d3-carnitine, dodecanoyl-d3-carnitine, and palmitoyl-d3-carnitine as internal standards. The supernatant is evaporated and the residue treated with n-butanolic hydrochloric acid yielding the acylcarnitines for analysis as their n-butyl esters. (Tortorelli S, Hahn SH, Cowan TM, et al. The urinary excretion of glutarylcarnitine is an informative tool in the biochemical diagnosis of glutaric aciduria type I. *Mol Genet Metab.* 2005;84(2):137-143; Miller MJ, Cusmano-Ozog K, Oglesbee D, Young S. ACMG Laboratory Quality Assurance Committee. Laboratory analysis of acylcarnitines, 2020 update: a technical standard of the American College of Medical Genetics and Genomics [ACMG]. *Genet Med.* 2021;23(2):249-258)

### PDF Report

No

### Day(s) Performed

Monday, Wednesday, Friday

### Report Available

2 to 5 days

### Specimen Retention Time

1 month

### 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**

82017

**LOINC® Information**

Test ID	Test Order Name	Order LOINC® Value
C4U	C4 Acylcarnitine, QN, U	53111-1

Result ID	Test Result Name	Result LOINC® Value
88829	C4 Acylcarnitine, QN, U	53111-1
28075	C4 Interpretation	59462-2
34468	Reviewed By	18771-6