

ACYLCARNITINE PROFILE

Relevant disorders

Isovaleric acidaemia; Propionic acidaemia; Methylmalonic acidaemia; Malonic acidaemia; 3-Hydroxy-3-methylglutaryl-CoA lyase deficiency; 3-Ketothiolase deficiency; Glutaric aciduria type 1; Biotinidase deficiency; 3-Methylcrotonyl-CoA carboxylase deficiency; Holocarboxylase synthase deficiency;

Carnitine transporter deficiency (primary carnitine deficiency); Carnitine Palmitoyl Transferase deficiency type 1 (CPT1); Carnitine Palmitoyl Transferase deficiency type 2 (CPT2); Carnitine-acylcarnitine transferase deficiency (CACT); Short/Medium/Very-long-chain acyl-CoA dehydrogenase deficiencies (SCAD/MCAD/VLCAD); Long-chain hydroxyacyl-CoA dehydrogenase deficiency (LCHAD) [as part of Mitochondrial Trifunctional Protein deficiency or isolated deficiency]; Multiple acyl-CoA dehydrogenase deficiency (Glutaric aciduria type 2 [GA2]/ Ethylmalonic-adipic aciduria); also some respiratory chain defects affecting fatty acid oxidative processes.

Related Metabolic Tests

Intermediary metabolites (glucose, lactate, free fatty acids, 3 hydroxy butyrate)

Organic acids

Enzyme assays on cultured cells (e.g. CPT II, Glutarate Dehydrogenase)

Indication for Test

Acylcarnitines are formed from acyl-CoA esters, to enable transport of vital intermediates across the inner mitochondrial membrane for beta-oxidation. They also transport accumulating acyl-CoA esters from many pathways out of mitochondria, peroxisomes and cells, for excretion in urine. Thus, acylcarnitine concentrations in blood reflect acyl-CoA status, especially in disorders of amino acid and fatty acid catabolism.

Measurement of carnitine/acylcarnitine in urine is used to calculate tubular reabsorption of free and acylcarnitine (paired plasma sample also required).

Please note: total carnitine is calculated by summing the acylcarnitines.

Methodology

Acylcarnitines are analysed using Electrospray Tandem Mass Spectrometry (ESI-MS/MS) using deuterium-labelled acylcarnitine internal standards.

Sample requirements

Plasma

0.5ml Lithium heparin plasma (or serum).

Dried blood spots

Guthrie card, 2 spots required. Can be prepared by SCH laboratory - send Lithium Heparin whole blood (NOT EDTA).

Bile (post mortem)

Prepare as blood spots, 2 spots required. Can be prepared by SCH laboratory – send in a plain tube.

CSF (post mortem)

0.1ml in a plain tube.

Fibroblasts

Send a skin biopsy in culture medium or cultured fibroblasts in culture medium.

Urine

1ml in a plain universal. If calculation of tubular reabsorption of free and acylcarnitine is required a paired plasma sample is essential.

Turn Around Times

Plasma, dried blood spots: 5 – 14 days (but if requested urgently can be performed more quickly).

Plasma, dried blood spots (post mortem): 1 month

Bile, CSF: 4 – 6 weeks

Fibroblasts: 2 months

Transport information/Contact details

Send all samples by first class post to:

Department of Clinical Chemistry
Sheffield Children's NHS Foundation Trust
Western Bank, Sheffield
S10 2TH, UK

Dr Simon Olpin (Clinical Scientist)
0114 2717267

Reference Ranges

Reference ranges used are a combination of our own collected data and that from the Royal Victoria Hospital, Newcastle and published data (JIMD). Please note: these reference ranges are only valid with data produced by the Department of Clinical Chemistry, Sheffield Children's NHS Foundation Trust

COMPOUND	IS (SCH)	DBS ($\mu\text{mol/L}$)	PLASMA ($\mu\text{mol/L}$)
C0 (free carn)	d9-C0	5.3-34.7	15-53
C2-carn	d3-C2	5.5-38	5-27
C3-carn	d3-C3	<3.6	<1.30
C4-carn	d3-C4	<0.5	<0.40
Tiglyl-carn	d9-C5	<0.02	<0.04
C5-carn	d9-C5	<0.6	<0.50
C4(OH)	d9-C5	<0.05	<0.07
C6-carn	d9-C5	<0.2	<0.12
(OH)C5-carn	d9-C5	<0.5	<0.06
C8-carn	d3-C8	<0.3	<0.22
C10:1 -carn	d3-C8	<0.1	<0.22
C10-carn	d3-C8	<0.3	<0.30
MMA/Succ-carn (C4-DC)	-	-	-
Glutaryl-carn (C5-DC)	d3-C8	<0.1	<0.06
C12:1-carn	d9-C14	<0.1	<0.10
C12-carn	d9-C14	<0.3	<0.10
Methylglut-carn (C6-DC)	d9-C14	<0.1	<0.02
C14:2-carn	d9-C14		
C14:1-carn	d9-C14	<0.2	<0.18
C14-carn	d9-C14	<0.3	<0.2
C16:1 -carn	d3-C16	<0.2	<0.08
C16-carn	d3-C16	<5.3	<0.24
(OH)C16:1-carn	d3-C16	<0.05	-
(OH)C16-carn	d3-C16	<0.05	<0.05
C18:2 -carn	d3-C16	<0.9	<0.18
C18:1 -carn	d3-C16	<3.1	<0.28
C18-carn	d3-C16	<1.4	<0.10
(OH)C18:1-carn	d3-C16	<0.05	<0.05
(OH)C18-carn	d3-C16	<0.05	<0.05

References

- Vreken et al. (1999) Quantitative plasma acylcarnitine analysis using electrospray tandem mass spectrometry for the diagnosis of organic acidaemias and fatty acid oxidation defects. *J. Inherit Metab Dis* **22**: 302 - 306