3-hydroxyacyl-CoA dehydrogenase deficiency

3-hydroxyacyl-CoA dehydrogenase deficiency is an inherited condition that prevents the body from converting certain fats to energy, particularly during prolonged periods without food (fasting).

Initial signs and symptoms of this disorder typically occur during infancy or early childhood and can include poor appetite, vomiting, diarrhea, and lack of energy (lethargy). Affected individuals can also have muscle weakness (hypotonia), liver problems, low blood sugar (hypoglycemia), and abnormally high levels of insulin (hyperinsulinism). Insulin controls the amount of sugar that moves from the blood into cells for conversion to energy. Individuals with 3-hydroxyacyl-CoA dehydrogenase deficiency are also at risk for complications such as seizures, life-threatening heart and breathing problems, coma, and sudden death. This condition may explain some cases of sudden infant death syndrome (SIDS), which is defined as unexplained death in babies younger than 1 year.

Problems related to 3-hydroxyacyl-CoA dehydrogenase deficiency can be triggered by periods of fasting or by illnesses such as viral infections. This disorder is sometimes mistaken for Reye syndrome, a severe disorder that may develop in children while they appear to be recovering from viral infections such as chicken pox or flu. Most cases of Reye syndrome are associated with the use of aspirin during these viral infections.

Frequency

The exact incidence of 3-hydroxyacyl-CoA dehydrogenase deficiency is unknown; it has been reported in only a small number of people worldwide.

Causes

Mutations in the HADH gene cause 3-hydroxyacyl-CoA dehydrogenase deficiency. The HADH gene provides instructions for making an enzyme called 3-hydroxyacyl-CoA dehydrogenase.

Normally, through a process called fatty acid oxidation, several enzymes work in a step-wise fashion to break down (metabolize) fats and convert them to energy. The 3-hydroxyacyl-CoA dehydrogenase enzyme is required for a step that metabolizes groups of fats called medium-chain fatty acids and short-chain fatty acids.

Mutations in the HADH gene lead to a shortage of 3-hydroxyacyl-CoA dehydrogenase. Medium-chain and short-chain fatty acids cannot be metabolized properly without sufficient levels of this enzyme. As a result, these fatty acids are not converted to energy, which can lead to characteristic features of 3-hydroxyacyl-CoA dehydrogenase deficiency, such as lethargy and hypoglycemia. Medium-chain and short-chain fatty
acids that are not broken down can build up in tissues and damage the liver, heart, and muscles, causing serious complications.

Conditions that disrupt the metabolism of fatty acids, including 3-hydroxyacyl-CoA dehydrogenase deficiency, are known as fatty acid oxidation disorders.

Inheritance Pattern
This condition is inherited in an autosomal recessive pattern, which means both copies of the gene in each cell have mutations. The parents of an individual with an autosomal recessive condition each carry one copy of the mutated gene, but they typically do not show signs and symptoms of the condition.

Other Names for This Condition
- 3-alpha-hydroxyacyl-coenzyme A dehydrogenase deficiency
- 3-hydroxyacyl-coenzyme A dehydrogenase deficiency
- deficiency of 3-hydroxyacyl-CoA dehydrogenase
- HAD deficiency
- HADH deficiency
- HADHSC deficiency
- L-3-alpha-hydroxyacyl-CoA dehydrogenase, short chain, deficiency
- M/SCHAD deficiency
- SCHAD deficiency

Diagnosis & Management

Formal Diagnostic Criteria
- ACT Sheet: Elevated C4-OH Acylcarnitine
  https://www.ncbi.nlm.nih.gov/books/NBK55827/bin/C4-OH.pdf

Genetic Testing Information
- What is genetic testing?
  /primer/testing/genetictesting
- Genetic Testing Registry: Deficiency of 3-hydroxyacyl-CoA dehydrogenase

Research Studies from ClinicalTrials.gov
- ClinicalTrials.gov
  https://clinicaltrials.gov/ct2/results?cond=%223-hydroxyacyl-CoA+dehydrogenase+deficiency%22+OR+%223-hydroxyacyl-coenzyme+A+dehydrogenase+deficiency%22
Other Diagnosis and Management Resources

- Baby's First Test
  https://www.babysfirsttest.org/newborn-screening/conditions/mediumshort-chain-1-3-hydroxyacyl-coa-dehydrogenase-deficiency

- United Mitochondrial Disease Foundation: Treatments & Therapies
  https://www.umdf.org/what-is-mitochondrial-disease/treatments-therapies/

Additional Information & Resources

Health Information from MedlinePlus

- Health Topic: Hypoglycemia
  https://medlineplus.gov/hypoglycemia.html

- Health Topic: Lipid Metabolism Disorders
  https://medlineplus.gov/lipidmetabolismdisorders.html

- Health Topic: Newborn Screening
  https://medlineplus.gov/newbornscreening.html

Genetic and Rare Diseases Information Center

- 3-alpha hydroxyacyl-CoA dehydrogenase deficiency
  https://rarediseases.info.nih.gov/diseases/9870/3-alpha-hydroxyacyl-coa-dehydrogenase-deficiency

Educational Resources

- Illinois Department of Public Health
  http://www.idph.state.il.us/HealthWellness/fs/mcad.htm

- MalaCards: 3-hydroxyacyl-coa dehydrogenase deficiency
  https://www.malacards.org/card/3_hydroxyacyl_coa_dehydrogenase_deficiency

- Orphanet: Hyperinsulinism due to short chain 3-hydroxylacyl-CoA dehydrogenase deficiency
  https://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=71212

- Screening, Technology and Research in Genetics (STAR-G)
  http://www.newbornscreening.info/Parents/fattyaciddisorders/SCHADD.html

Patient Support and Advocacy Resources

- FOD (Fatty Oxidation Disorders) Family Support Group
  https://fodsupport.org/

- Metabolic Support (UK)
  https://www.metabolicsupportuk.org/

- United Mitochondrial Disease Foundation
  https://www.umdf.org/
Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%283-hydroxyacyl-CoA+dehydrogenase+deficiency+AND+short+chain%5BTIAB%5D%29+OR+%28SCHAD%5BTIAB%5D%29+OR+%28M/SCHAD%5BTIAB%5D%29+OR+%28short+chain+3-hydroxyacyl-CoA+dehydrogenase%5BTIAB%5D%29+NOT+%28HADH2%5BALL%5D%29+NOT+%28long-chain%5BALL%5D%29+NOT+%28HSD10%5BALL%5D%29+NOT+%28hydroxysteroid+dehydrogenase%5BALL%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+3600+days%22%5Bdp%5D

Catalog of Genes and Diseases from OMIM

- 3-HYDROXYACYL-CoA DEHYDROGENASE DEFICIENCY
  http://omim.org/entry/231530

Sources for This Summary

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16725361

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/10347277

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/18036338

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/11826276

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/10931422

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16176262

Reprinted from Genetics Home Reference: