Arginase deficiency

Arginase deficiency is an inherited disorder that causes the amino acid arginine (a building block of proteins) and ammonia to accumulate gradually in the blood. Ammonia, which is formed when proteins are broken down in the body, is toxic if levels become too high. The nervous system is especially sensitive to the effects of excess ammonia.

Arginase deficiency usually becomes evident by about the age of 3. It most often appears as stiffness, especially in the legs, caused by abnormal tensing of the muscles (spasticity). Other symptoms may include slower than normal growth, developmental delay and eventual loss of developmental milestones, intellectual disability, seizures, tremor, and difficulty with balance and coordination (ataxia). Occasionally, high protein meals or stress caused by illness or periods without food (fasting) may cause ammonia to accumulate more quickly in the blood. This rapid increase in ammonia may lead to episodes of irritability, refusal to eat, and vomiting.

In some affected individuals, signs and symptoms of arginase deficiency may be less severe, and may not appear until later in life.

Frequency

Arginase deficiency is a very rare disorder; it has been estimated to occur once in every 300,000 to 1,000,000 individuals.

Causes

Mutations in the *ARG1* gene cause arginase deficiency.

Arginase deficiency belongs to a class of genetic diseases called urea cycle disorders. The urea cycle is a sequence of reactions that occurs in liver cells. This cycle processes excess nitrogen, generated when protein is used by the body, to make a compound called urea that is excreted by the kidneys.

The *ARG1* gene provides instructions for making an enzyme called arginase. This enzyme controls the final step of the urea cycle, which produces urea by removing nitrogen from arginine. In people with arginase deficiency, arginase is damaged or missing, and arginine is not broken down properly. As a result, urea cannot be produced normally, and excess nitrogen accumulates in the blood in the form of ammonia. The accumulation of ammonia and arginine are believed to cause the neurological problems and other signs and symptoms of arginase deficiency.
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

- ARG1 deficiency
- Arginase Deficiency Disease
- Argininemia
- Hyperargininemia

Diagnosis & Management

Formal Diagnostic Criteria

- ACT Sheet: Increased Arginine
  https://www.ncbi.nlm.nih.gov/books/NBK55827/bin/Arginine.pdf

Formal Treatment/Management Guidelines

- New England Consortium of Metabolic Programs: Acute Illness Protocol
  http://newenglandconsortium.org/for-professionals/acute-illness-protocols/urea-cycle-disorders/arginase-deficiency/

Genetic Testing Information

- What is genetic testing?
  /primer/testing/genetictesting
- Genetic Testing Registry: Arginase deficiency

Research Studies from ClinicalTrials.gov

- ClinicalTrials.gov
  https://clinicaltrials.gov/ct2/results?cond=%22arginase+deficiency%22+OR+%22Hyperargininemia%22

Other Diagnosis and Management Resources

- Baby's First Test
  https://www.babysfirsttest.org/newborn-screening/conditions/argininemia
- GeneReview: Arginase Deficiency
  https://www.ncbi.nlm.nih.gov/books/NBK1159
- GeneReview: Urea Cycle Disorders Overview
  https://www.ncbi.nlm.nih.gov/books/NBK1217
• MedlinePlus Encyclopedia: Hereditary urea cycle abnormality
  https://medlineplus.gov/ency/article/000372.htm

• National Organization for Rare Disorders (NORD) Physician Guide: Urea Cycle Disorders
  https://rarediseases.org/physician-guide/urea-cycle-disorders/

**Additional Information & Resources**

**Health Information from MedlinePlus**

• Encyclopedia: Hereditary urea cycle abnormality
  https://medlineplus.gov/ency/article/000372.htm

• Health Topic: Amino Acid Metabolism Disorders
  https://medlineplus.gov/aminoacidmetabolismdisorders.html

• Health Topic: Genetic Brain Disorders
  https://medlineplus.gov/geneticbraindisorders.html

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

**Genetic and Rare Diseases Information Center**

• Arginase deficiency
  https://rarediseases.info.nih.gov/diseases/5840/arginase-deficiency

**Educational Resources**

• Cincinnati Children’s Hospital
  https://www.cincinnatichildrens.org/health/u/ucd

• Connecticut Department of Public Health

• MalaCards: argininemia
  http://www.malacards.org/card/argininemia

• Orphanet: Argininemia
  https://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=90

• Screening, Technology and Research in Genetics
  http://www.newbornscreening.info/Parents/aminoaciddisorders/argininemia.html

**Patient Support and Advocacy Resources**

• Metabolic Support UK
  https://www.metabolicsupportuk.org/

• National Organization for Rare Disorders (NORD)
  https://rarediseases.org/rare-diseases/arginase-deficiency/
• National Urea Cycle Disorders Foundation
  http://www.nucdf.org/

• Urea Cycle Disorders Consortium
  https://www.rarediseasesnetwork.org/cms/UCDC

Clinical Information from GeneReviews

• Arginase Deficiency
  https://www.ncbi.nlm.nih.gov/books/NBK1159

• Urea Cycle Disorders Overview
  https://www.ncbi.nlm.nih.gov/books/NBK1217

Scientific Articles on PubMed

• PubMed
  %5D%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last
  +3600+days%22%5Bdp%5D

Catalog of Genes and Diseases from OMIM

• ARGININEMIA
  http://omim.org/entry/207800

Sources for This Summary

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  Disorders Overview. 2003 Apr 29 [updated 2017 Jun 22]. In: Pagon RA, Adam MP, Ardinger HH,
  Wallace SE, Amemiya A, Bean LJH, Bird TD, Ledbetter N, Mefford HC, Smith RJH, Stephens K,
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/20301396

• Crombez EA, Cederbaum SD. Hyperargininemia due to liver arginase deficiency. Mol Genet Metab.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/15694174

• Endo F, Matsuura T, Yanagita K, Matsuda I. Clinical manifestations of inborn errors of the
  1605S-1609S; discussion 1630S-1632S, 1667S-1672S. Review.
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Reprinted from Genetics Home Reference:  

Reviewed: August 2013  
Published: September 18, 2018

Lister Hill National Center for Biomedical Communications  
U.S. National Library of Medicine  
National Institutes of Health  
Department of Health & Human Services