17-beta hydroxysteroid dehydrogenase 3 deficiency

17-beta hydroxysteroid dehydrogenase 3 deficiency is a condition that affects male sexual development. People with this condition are genetically male, with one X and one Y chromosome in each cell, and they have male gonads (testes). Their bodies, however, do not produce enough of a male sex hormone (androgen) called testosterone. Testosterone has a critical role in male sexual development, and a shortage of this hormone disrupts the formation of the external sex organs before birth.

Most people with 17-beta hydroxysteroid dehydrogenase 3 deficiency are born with external genitalia that appear female. In some cases, the external genitalia do not look clearly male or clearly female (sometimes called ambiguous genitalia). Still other affected infants have genitalia that appear predominantly male, often with an unusually small penis (micropenis) or the urethra opening on the underside of the penis (hypospadias).

During puberty, people with this condition develop some male secondary sex characteristics, such as increased muscle mass, deepening of the voice, and development of male pattern facial and body hair. In addition to these changes typical of adolescent boys, some affected individuals may also experience breast enlargement (gynecomastia). Despite having testes, people with this disorder are generally unable to father children (infertile).

Children with 17-beta hydroxysteroid dehydrogenase 3 deficiency are often raised as girls. About half of these individuals adopt a male gender role in adolescence or early adulthood.

Frequency

17-beta hydroxysteroid dehydrogenase 3 deficiency is a rare disorder. Researchers have estimated that this condition occurs in approximately 1 in 147,000 newborns. It is more common in the Arab population of Gaza, where it affects 1 in 200 to 300 people.

Causes

Mutations in the HSD17B3 gene cause 17-beta hydroxysteroid dehydrogenase 3 deficiency. The HSD17B3 gene provides instructions for making an enzyme called 17-beta hydroxysteroid dehydrogenase 3. This enzyme is active in the testes, where it helps to produce testosterone from a weaker precursor androgen called androstenedione.

Mutations in the HSD17B3 gene result in a 17-beta hydroxysteroid dehydrogenase 3 enzyme with little or no activity, reducing production of testosterone from androstenedione. The shortage of the stronger androgen affects the development of
the reproductive tract in the male fetus, resulting in the abnormalities in the external sex organs that occur in 17-beta hydroxysteroid dehydrogenase 3 deficiency.

At puberty, conversion of androstenedione to testosterone increases in various tissues of the body through processes involving other enzymes. The additional testosterone results in the development of male secondary sex characteristics in adolescents, including those with 17-beta hydroxysteroid dehydrogenase 3 deficiency.

A portion of the androstenedione is also converted to the female sex hormone estrogen. Since impairment of the conversion to testosterone in this disorder results in excess androstenedione in the body, a corresponding excess of estrogen may be produced, leading to breast enlargement in some affected individuals.

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. Individuals who are genetically male and have two copies of a mutated gene in each cell are affected by 17-beta hydroxysteroid dehydrogenase 3 deficiency. People with two mutations who are genetically female do not usually experience any signs and symptoms of this disorder.

Other Names for This Condition

- 17-beta hydroxysteroid dehydrogenase III deficiency
- 17-ketosteroid reductase deficiency of testis
- 17-KSR deficiency
- neutral 17-beta-hydroxysteroid oxidoreductase deficiency
- pseudohermaphroditism, male, with gynecomastia
- testosterone 17-beta-dehydrogenase deficiency

Diagnosis & Management

Genetic Testing Information

- What is genetic testing?
  /primer/testing/genetictesting
- Genetic Testing Registry: 17-Beta-Hydroxysteroid Dehydrogenase III Deficiency

Research Studies from ClinicalTrials.gov

- ClinicalTrials.gov
  https://clinicaltrials.gov/ct2/results?cond=%22Pseudohermaphroditism%22+OR+%2217-beta+hydroxy+dehydrogenase+deficiency%22
Other Diagnosis and Management Resources

- MedlinePlus Encyclopedia: Ambiguous Genitalia
  https://medlineplus.gov/ency/article/003269.htm
- MedlinePlus Encyclopedia: Intersex
  https://medlineplus.gov/ency/article/001669.htm

Additional Information & Resources

Health Information from MedlinePlus

- Encyclopedia: Ambiguous Genitalia
  https://medlineplus.gov/ency/article/003269.htm
- Encyclopedia: Intersex
  https://medlineplus.gov/ency/article/001669.htm
- Health Topic: Endocrine Diseases
  https://medlineplus.gov/endocrinediseases.html
- Health Topic: Infertility
  https://medlineplus.gov/infertility.html

Genetic and Rare Diseases Information Center

- 17-beta hydroxysteroid dehydrogenase 3 deficiency
  https://rarediseases.info.nih.gov/diseases/5659/17-beta-hydroxysteroid-dehydrogenase-3-deficiency

Educational Resources

- Accord Alliance
  http://www.accordalliance.org/dsd-guidelines/
- Orphanet: 46,XY disorder of sex development due to 17-beta-hydroxysteroid dehydrogenase 3 deficiency
  https://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=752

Patient Support and Advocacy Resources

- AIS-DSD Support Group
  http://aisdsd.org/
- MAGIC Foundation
  https://www.magicfoundation.org/
- Resolve: The National Infertility Association
  https://resolve.org/
Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%2817-beta+hydroxysteroid+dehydrogenase+deficiency%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+3600+days%22%5Bdp%5D

Catalog of Genes and Diseases from OMIM

- 17-BETA HYDROXYSTEROID DEHYDROGENASE III DEFICIENCY
  http://omim.org/entry/264300

Medical Genetics Database from MedGen

- 17-Beta-Hydroxysteroid Dehydrogenase III Deficiency

Sources for This Summary

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/26956191

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/19498320

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/23295294

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/28859874

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/18296911

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/23435447


Reviewed: May 2018
Published: February 11, 2020

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