X-linked creatine deficiency

Description

X-linked creatine deficiency is an inherited disorder that primarily affects the brain. People with this disorder have intellectual disability, which can range from mild to severe, and delayed speech development. Some affected individuals develop behavioral disorders such as attention-deficit/hyperactivity disorder (ADHD) or autistic behaviors that affect communication and social interaction. They may also experience seizures. Children with X-linked creatine deficiency may grow slower and develop motor skills, such as sitting and walking, later than their peers. Affected individuals tend to tire easily.

A small number of people with X-linked creatine deficiency have additional signs and symptoms including abnormal heart rhythms, an unusually small head (microcephaly), or distinctive facial features such as a broad forehead and a flat or sunken appearance of the middle of the face (midface hypoplasia).

Frequency

The prevalence of X-linked creatine deficiency is unknown. More than 150 affected individuals have been identified. The disorder has been estimated to account for between 1 and 2 percent of males with intellectual disability.

Causes

Variants (also known as mutations) in the *SLC6A8* gene cause X-linked creatine deficiency. The *SLC6A8* gene provides instructions for making a protein that transports a compound called creatine into cells. Creatine is needed for the body to store and use energy properly.

SLC6A8 gene variants impair the transporter protein's ability to bring creatine into cells, resulting in a shortage (deficiency) of creatine. The effects of creatine deficiency are most severe in organs and tissues that require large amounts of energy, especially the brain.

Learn more about the gene associated with X-linked creatine deficiency

- SLC6A8

Inheritance

This condition is inherited in an X-linked pattern. The gene associated with this condition is located on the X chromosome, which is one of the two sex chromosomes. In females (who have two X chromosomes), a variant in one of the two copies of the gene in each cell may or may not cause the disorder. In males (who have only one X chromosome), a variant in the only copy of the gene in each cell causes the disorder. A characteristic of X-linked inheritance is that fathers cannot pass X-linked traits to their sons.

In most cases of X-linked inheritance, males experience more severe symptoms of the disorder than females. About half of females with one altered copy of the *SLC6A8* gene in each cell have intellectual disability, learning difficulties, or behavioral problems. Other females with one altered copy of the *SLC6A8* gene in each cell have no noticeable neurological problems.

Other Names for This Condition

- Creatine transporter defect
- Creatine transporter deficiency
- SLC6A8 deficiency
- SLC6A8-related creatine transporter deficiency
- X-linked creatine deficiency syndrome

Additional Information & Resources

Genetic Testing Information

- Genetic Testing Registry: Creatine transporter deficiency (https://www.ncbi.nlm.nih.gov/gtr/conditions/C1845862/)

Genetic and Rare Diseases Information Center

- X-linked creatine transporter deficiency (https://rarediseases.info.nih.gov/diseases/1608/index)

Patient Support and Advocacy Resources

- National Organization for Rare Disorders (NORD) (https://rarediseases.org/)

Clinical Trials

- ClinicalTrials.gov (https://clinicaltrials.gov/search?cond=%22X-linked creatine deficiency%22)

Catalog of Genes and Diseases from OMIM

- CEREBRAL CREATINE DEFICIENCY SYNDROME 1; CCDS1 (https://omim.org/entry/300352)

Scientific Articles on PubMed

- PubMed (https://pubmed.ncbi.nlm.nih.gov/?term=%28%28x-linked+creatine+deficiency+syndrome%5BTIAB%5D%29+OR+%28creatine+transporter+deficiency%5BTIAB%5D%29+OR+%28creatine+transporter+defect%5BTIAB%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+3600+days%22%5Bdp%5D)

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