SLC3A1 Gene

Subjects: Genetics & Heredity
Contributor: Karina Chen

solute carrier family 3 member 1

Keywords: genes

1. Normal Function

The *SLC3A1* gene provides instructions for producing one part (subunit) of a protein made primarily in the kidneys. This subunit joins with another protein subunit, produced from the *SLC7A9* gene, to form a transporter protein complex. During the process of urine formation in the kidneys, this protein complex absorbs particular protein building blocks (amino acids) back into the blood. In particular, the amino acids cystine, ornithine, arginine, and lysine are absorbed back into the blood through this mechanism.

2. Health Conditions Related to Genetic Changes

2.1. Cystinuria

More than 120 mutations in the *SLC3A1* gene have been found to cause cystinuria. Many of these mutations alter a single DNA building block (nucleotide) or insert or delete a small number of nucleotides in the *SLC3A1* gene. These changes lead to an abnormally functioning transporter protein complex, which causes certain amino acids to become concentrated in the urine. Cystine is the only amino acid that forms crystals and stones in the bladder or kidneys, leading to the signs and symptoms of cystinuria.

2.2. Other disorders

Some people with cystinuria have large DNA deletions that remove not only the *SLC3A1* gene but one or more neighboring genes. Individuals with these large DNA deletions have the signs and symptoms of cystinuria, but they can also have other features.

Deletions of the *SLC3A1* gene and the neighboring *PREPL* gene cause hypotonia-cystinuria syndrome. In addition to cystinuria, people with this condition have low muscle tone (hypotonia) and poor feeding, which usually improves by early childhood. They may also have droopy eyelids (ptosis), an elongated head (dolichocephaly), and mild intellectual disability. Most people with this condition have short stature.

Deletions of the *SLC3A1* gene, the *PREPL* gene, and the *C2orf34* gene cause atypical hypotonia-cystinuria syndrome. In addition to the symptoms of hypotonia-cystinuria syndrome, individuals with the atypical form have mild to moderate delay in the development of mental and motor skills (psychomotor delay).

Deletions of the *SLC3A1* gene, the *PREPL* gene, the *C2orf34* gene, and the *PPM1B* gene cause 2p21 deletion syndrome. In addition to all the symptoms of the previous syndromes, individuals with 2p21 deletion syndrome have seizures soon after birth, moderate to severe psychomotor delay, and impairments in the process from which cells derive much of their energy (oxidative phosphorylation). People with this condition typically have a characteristic facial appearance with a prominent forehead, long eyelashes, a flat nasal bridge, and abnormally turned ears.

3. Other Names for This Gene

- amino acid transporter 1
- ATR1
- CSNU1
- D2H

- NBAT
- RBAT
- SLC31_HUMAN
- solute carrier family 3 (amino acid transporter heavy chain), member 1
- solute carrier family 3 (cystine, dibasic and neutral amino acid transporters), member 1
- solute carrier family 3 (cystine, dibasic and neutral amino acid transporters, activator of cystine, dibasic and neutral amino acid transport), member 1
- solute carrier family 3, member 1

References

1. Chabrol B, Martens K, Meulemans S, Cano A, Jaeken J, Matthijs G, Creemers JW. Deletion of C2orf34, PREPL and SLC3A1 causes atypical hypotonia-cystinuriasyndrome. J Med Genet. 2008 May;45(5):314-8. doi: 10.1136/jmg.2007.055475.
2. Dello Strologo L, Pras E, Pontesilli C, Beccia E, Ricci-Barbini V, de Sanctis L, Ponzone A, Gallucci M, Bisceglia L, Zelante L, Jimenez-Vidal M, Font M,Zorzano A, Rousaud F, Nunes V, Gasparini P, Palacín M, Rizzoni G. Comparisonbetween SLC3A1 and SLC7A9 cystinuria patients and carriers: a need for a newclassification. J Am Soc Nephrol. 2002 Oct;13(10):2547-53.
3. Fernández E, Carrascal M, Rousaud F, Abián J, Zorzano A, Palacín M, Chillarón J. rBAT-b(0,+)AT heterodimer is the main apical reabsorption system for cystinein the kidney. Am J Physiol Renal Physiol. 2002 Sep;283(3):F540-8.
4. Font-Llitjós M, Jiménez-Vidal M, Bisceglia L, Di Perna M, de Sanctis L,Rousaud F, Zelante L, Palacín M, Nunes V. New insights into cystinuria: 40 newmutations, genotype-phenotype correlation, and digenic inheritance causingpartial phenotype. J Med Genet. 2005 Jan;42(1):58-68.
5. Goodyer P. The molecular basis of cystinuria. Nephron Exp Nephrol.2004;98(2):e45-9. Review.
6. Langman CB. The molecular basis of kidney stones. Curr Opin Pediatr. 2004Apr;16(2):188-93. Review.
7. Martens K, Heulens I, Meulemans S, Zaffanello M, Tilstra D, Hes FJ, Rooman R, François I, de Zegher F, Jaeken J, Matthijs G, Creemers JW. Global distributionof the most prevalent deletions causing hypotonia-cystinuria syndrome. Eur J Hum Genet. 2007 Oct;15(10):1029-33.
8. Martens K, Jaeken J, Matthijs G, Creemers JW. Multi-system disorder syndromes associated with cystinuria type I. Curr Mol Med. 2008 Sep;8(6):544-50. Review.
9. Schmidt C, Vester U, Wagner CA, Lahme S, Hesse A, Hoyer P, Lang F, Zerres K,Eggermann T; Arbeitsgemeinschaft für Pädiatrische Nephrologie. Significantcontribution of genomic rearrangements in SLC3A1 and SLC7A9 to the etiology ofcystinuria. Kidney Int. 2003 Nov;64(5):1564-72.