BICD2 Gene

Subjects: Genetics & Heredity
Contributor: Vicky Zhou

BICD cargo adaptor 2

Keywords: genes

1. Normal Function

The *BICD2* gene provides instructions for making one of a family of proteins called golgins. Golgins help maintain the structure of a cell component called the Golgi apparatus, in which newly produced proteins are modified so they can carry out their functions.

The BICD2 protein is found in all cells. The protein attaches (binds) to a group of proteins called the dynein complex, turning it on (activating it) and helping it bind to other cellular materials for transport. During transport, BICD2 stabilizes the dynein complex along a track-like system of small tubes called microtubules, similar to a conveyer belt. The BICD2 protein helps the dynein complex with protein transport, positioning of cell compartments, mobility of structures within the cell, and many other cell processes.

In nerve cells (neurons), the BICD2 protein helps the dynein complex transport sac-like structures called synaptic vesicles. These structures contain chemical messengers that allow neighboring cells to communicate with one another.

2. Health Conditions Related to Genetic Changes

2.1. Spinal muscular atrophy with lower extremity predominance

At least six mutations in the *BICD2* gene have been found to cause spinal muscular atrophy with lower extremity predominance (SMA-LED). This condition is characterized by muscle weakness and wasting (atrophy) in the lower limbs that often begins in infancy or childhood.

The *BICD2* gene mutations that cause SMA-LED replace single protein building blocks (amino acids). One mutation that has been found in multiple affected individuals and families replaces the amino acid serine with the amino acid leucine at position 107 in the BICD2 protein (written as Ser107Leu or S107L). This change and the other *BICD2* gene mutations increase the activity of the BICD2 protein. Overactivity of the BICD2 protein changes its ability to bind with the dynein complex, leading to reduced movement of proteins, synaptic vesicles, and other materials within cells. Decreased synaptic vesicle transport in neurons that control muscle movement (motor neurons), leading to impaired growth of neurons, is thought to contribute to the muscle weakness and atrophy experienced by people with SMA-LED. It is unclear why this condition primarily affects the lower limbs.

Additionally, *BICD2* gene mutations impair the protein's ability to maintain the structure of the Golgi apparatus within cells. As a result, the Golgi apparatus breaks down into small fragments and the altered BICD2 protein becomes trapped within these fragments. Loss of these cell components likely further contributes to the signs and symptoms of SMA-LED.

3. Other Names for This Gene

- bA526D8.1
- bic-D 2
- bicaudal D homolog 2
- coiled-coil protein BICD2
- cytoskeleton-like bicaudal D protein homolog 2
- homolog of Drosophila bicaudal D

- KIAA0699

References

1. Martinez-Carrera LA, Wirth B. Dominant spinal muscular atrophy is caused bymutations in BICD2, an important golgin protein. Front Neurosci. 2015 Nov5;9:401. doi: 10.3389/fnins.2015.00401.
2. Neveling K, Martinez-Carrera LA, Hölker I, Heister A, Verrips A,Hosseini-Barkooie SM, Gilissen C, Vermeer S, Penning s M, Meijer R, te Riele M,Frijns CJ, Suchowersky O, MacLaren L, Rudnik-Schöneborn S, Sinke RJ, Zerres K,Lowry RB, Lemmink HH, Garbes L, Veltman JA, Schelhaas HJ, Scheffer H, Wirth B.Mutations in BICD2, which encodes a golgin a nd important motor adaptor, causecongenital autosomal-dominant spinal muscular atrophy. Am J Hum Genet. 2013 Jun 6;92(6):946-54. doi: 10.1016/j.ajhg.2013.04.011.
3. Rossor AM, Oates EC, Salter HK, Liu Y, Murphy SM, Schule R, Gonzalez MA, ScotoM, Phadke R, Sewry CA, Houlden H, Jordanova A, Tournev I, Chamova T, LitvinenkoI, Zuchner S, Herrmann DN, Blake J, Sowden JE, Acsadi G, Rodrigu ez ML, MenezesMP, Clarke NF, Auer Grumbach M, Bullock SL, Muntoni F, Reilly MM, North KN.Phenotypic and molec ular insights into spinal muscular atrophy due to mutationsin BICD2. Brain. 2015 Feb;138(Pt 2):293-310. doi: 10.1093/b rain/awu356.