MYH3 Gene

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myosin heavy chain 3

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1. Introduction

The *MYH3* gene provides instructions for making a protein called embryonic skeletal muscle myosin heavy chain 3. This protein belongs to a group of proteins called myosins, which are involved in cell movement and transport of materials within and between cells. Thick filaments made of myosin, along with thin filaments of another protein called actin, are the primary components of muscle fibers and are important for muscle tensing (contraction).

Each myosin protein complex consists of two pairs of light chains, which regulate the complex and are produced from several other genes, and two heavy chains such as that produced from the *MYH3* gene. The heavy chains each have two parts: a head region and a tail region. The head region interacts with actin and includes a segment that attaches (binds) to ATP. ATP is a molecule that supplies energy for cells' activities, including muscle contraction. The long tail region of the myosin heavy chain interacts with other proteins, including the tail regions of other myosins, enabling them to form thick filaments.

Embryonic skeletal muscle myosin heavy chain 3 forms part of a myosin protein complex that is normally active only before birth and is important for early development of the muscles.

2. Health Conditions Related to Genetic Changes

2.1. Freeman-Sheldon syndrome

At least 26 *MYH3* gene mutations have been identified in people with Freeman-Sheldon syndrome. This disorder affects muscle and skeletal development before birth and is characterized by joint deformities (contractures) that restrict movement in the hands and feet. Researchers suggest that the *MYH3* mutations that cause Freeman-Sheldon syndrome affect the way the embryonic skeletal muscle myosin heavy chain 3 protein interacts with ATP, reducing the ability of fetal muscle cells to contract. This impairment of muscle contraction may interfere with muscle development in the fetus, resulting in the contractures and other muscle and skeletal abnormalities associated with Freeman-Sheldon syndrome. It is unknown how *MYH3* gene mutations relate to other features of this disorder.

2.2. Sheldon-Hall syndrome

At least 15 *MYH3* gene mutations have been identified in people with Sheldon-Hall syndrome, a muscle and skeletal disorder similar to Freeman-Sheldon syndrome (described above) that impairs joint movement in the hands and feet. The *MYH3* gene mutations that cause Sheldon-Hall syndrome are believed to interfere with the ability of embryonic skeletal muscle myosin heavy chain 3 protein to bind with actin and other muscle proteins, and may also impair the formation of thick filaments. The mutations likely prevent muscle contractions from being properly controlled and interfere with muscle development before birth, resulting in the contractures and other muscle and skeletal abnormalities associated with Sheldon-Hall syndrome.

3. Other Names for This Gene

- HEMHC
- muscle embryonic myosin heavy chain
- MYH3_HUMAN

- MYHC-EMB
- MYHSE1
- myosin heavy chain, fast skeletal muscle, embryonic
- myosin, heavy chain 3, skeletal muscle, embryonic
- myosin, heavy polypeptide 3, skeletal muscle, embryonic
- myosin, skeletal, heavy chain, embryonic 1
- myosin-3
- SMHCE

References

1. Beck AE, McMillin MJ, Gildersleeve HI, Kezele PR, Shively KM, Carey JC,Regnier M, Bamshad MJ. Spectrum of mutations that cause distal arthrogryposistypes 1 and 2B. Am J Med Genet A. 2013 Mar;161A(3):550-5. doi:10.1002/ajmg.a.35809.
2. Carapito R, Goldenberg A, Paul N, Pichot A, David A, Hamel A, Dumant-Forest C,Leroux J, Ory B, Isidor B, Bahram S. Protein-altering MYH3 variants areassociated with a spectrum of phenotypes extending to spondylocarpotarsalsynostosis syndrome. Eur J Hum Genet. 2016 Dec;24(12):1746-1751. doi:10.1038/ejhg.2016.84.
3. Oldfors A, Lamont PJ. Thick filament diseases. Adv Exp Med Biol.2008;642:78-91. Review.
4. Tajsharghi H, Kimber E, Kroksmark AK, Jerre R, Tulinius M, Oldfors A.Embryonic myosin heavy-chain mutations cause distal arthrogryposis anddevelopmental myosin myopathy that persists postnatally. Arch Neurol. 2008Aug;65(8):1083-90. doi: 10.1001/archneur.65.8.1083. Erratum in: Arch Neurol. 2008Dec;65(12):1654.
5. Toydemir RM, Bamshad MJ. Sheldon-Hall syndrome. Orphanet J Rare Dis. 2009 Mar 23;4:11. doi: 10.1186/1750-1172-4-11. Review.
6. Toydemir RM, Rutherford A, Whitby FG, Jorde LB, Carey JC, Bamshad MJ.Mutations in embryonic myosin heavy chain (MYH3) cause Freeman-Sheldon syndromeand Sheldon-Hall syndrome. Nat Genet. 2006 May;38(5):561-5.