MYBPC3 gene

myosin binding protein C3

Normal Function

The *MYBPC3* gene provides instructions for making cardiac myosin binding protein C (cardiac MyBP-C), which is found in heart (cardiac) muscle cells. In these cells, cardiac MyBP-C is associated with a structure called the sarcomere, which is the basic unit of muscle contraction. Sarcomeres are made up of thick and thin filaments. The overlapping thick and thin filaments attach to each other and release, which allows the filaments to move relative to one another so that muscles can contract. Regular contractions of cardiac muscle pump blood to the rest of the body.

In cardiac muscle sarcomeres, cardiac MyBP-C attaches to thick filaments and keeps them from being broken down prematurely. Cardiac MyBP-C has molecules called phosphate groups attached to it; when the phosphate groups are removed, cardiac MyBP-C is broken down, followed by the breakdown of proteins of the thick filament. Cardiac MyBP-C also regulates how fast muscles contract, although the mechanism is not fully understood.

Health Conditions Related to Genetic Changes

Familial hypertrophic cardiomyopathy

Mutations in the *MYBPC3* gene are a common cause of familial hypertrophic cardiomyopathy, accounting for up to 30 percent of all cases. This condition is characterized by thickening (hypertrophy) of the cardiac muscle. Although some people with familial hypertrophic cardiomyopathy have no obvious health effects, all affected individuals have an increased risk of heart failure and sudden death.

MYBPC3 gene mutations that cause familial hypertrophic cardiomyopathy lead to an abnormally short or otherwise altered cardiac MyBP-C protein. It is unknown how these changes cause hypertrophy of the heart muscle.

Left ventricular noncompaction

At least four mutations in the *MYBPC3* gene have been found to cause left ventricular noncompaction, which occurs when the lower left chamber of the heart (left ventricle) does not develop correctly. The heart muscle is weakened and cannot pump blood

efficiently. These cardiac abnormalities can result in a wide range of outcomes from a complete lack of symptoms to sudden cardiac death. Other signs and symptoms include an irregular heart rhythm (arrhythmia), shortness of breath (dyspnea), and heart failure.

It is unclear how *MYBPC3* gene mutations cause left ventricular noncompaction. During normal development before birth, cardiac muscle gets compacted, becoming smooth and firm. *MYBPC3* gene mutations likely lead to changes in this process, resulting in a left ventricular cardiac muscle that is not compacted but is thick and spongy. This abnormal cardiac muscle is weak and cannot contract effectively, causing the varied signs and symptoms of left ventricular noncompaction.

Familial dilated cardiomyopathy

MedlinePlus Genetics provides information about Familial dilated cardiomyopathy

Other Names for This Gene

- C-protein, cardiac muscle isoform
- MYBP-C
- myosin-binding protein C, cardiac-type
- MYPC3_HUMAN

Additional Information & Resources

Tests Listed in the Genetic Testing Registry

- Tests of MYBPC3 (https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=4607[geneid])

Scientific Articles on PubMed

- PubMed (https://pubmed.ncbi.nlm.nih.gov/?term=%28%28MYBPC3%5BTIAB%5D%29+OR+%28cardiac+myosin+binding+protein+C%5BTIAB%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+720+days%22%5Bdp%5D)

Catalog of Genes and Diseases from OMIM

- MYOSIN-BINDING PROTEIN C, CARDIAC; MYBPC3 (https://omim.org/entry/600958)

Gene and Variant Databases

- NCBI Gene (https://www.ncbi.nlm.nih.gov/gene/4607)

- ClinVar (https://www.ncbi.nlm.nih.gov/clinvar?term=MYBPC3[gene])

References

- Bashyam MD, Savithri GR, Kumar MS, Narasimhan C, Nallari P. Molecular geneticsof familial hypertrophic cardiomyopathy (FHC). J Hum Genet. 2003;48(2):55-64.doi: 10.1007/s100380300007. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/12601548)
- Dong X, Fan P, Tian T, Yang Y, Xiao Y, Yang K, Liu Y, Zhou X. Recentadvancements in the molecular genetics of left ventricular noncompactioncardiomyopathy. Clin Chim Acta. 2017 Feb;465:40-44. doi:10.1016/j.cca.2016.12.013. Epub 2016 Dec 15. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/27989498)
- Finsterer J, Stollberger C, Towbin JA. Left ventricular noncompactioncardiomyopathy: cardiac, neuromuscular, and genetic factors. Nat Rev Cardiol.2017 Apr;14(4):224-237. doi: 10.1038/nrcardio.2016.207. Epub 2017 Jan 12. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/28079110)
- Hershberger RE, Norton N, Morales A, Li D, Siegfried JD, Gonzalez-Quintana J. Coding sequence rare variants identified in MYBPC3, MYH6, TPM1, TNNC1, and TNNI3from 312 patients with familial or idiopathic dilated cardiomyopathy. CircCardiovasc Genet. 2010 Apr;3(2):155-61. doi: 10.1161/CIRCGENETICS.109.912345.Epub 2010 Mar 9. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/20215591) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2908892/)
- Keren A, Syrris P, McKenna WJ. Hypertrophic cardiomyopathy: the geneticdeterminants of clinical disease expression. Nat Clin Pract Cardiovasc Med. 2008Mar;5(3):158-68. doi: 10.1038/ncpcardio1110. Epub 2008 Jan 29. Erratum In: NatClin Pract Cardiovasc Med. 2008 Nov;5(11):747. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/18227814)
- Kulikovskaya I, McClellan GB, Levine R, Winegrad S. Multiple forms of cardiacmyosin-binding protein C exist and can regulate thick filament stability. J GenPhysiol. 2007 May;129(5):419-28. doi: 10.1085/jgp.200609714. Erratum In: J GenPhysiol. 2009 Feb;133(2):225. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/17470661) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2154376/)
- Marston S, Copeland O, Gehmlich K, Schlossarek S, Carrier L. How do MYBPC3mutations cause hypertrophic cardiomyopathy? J Muscle Res Cell Motil. 2012May;33(1):75-80. doi: 10.1007/s10974-011-9268-3. Epub 2011 Nov 5. Erratum In: JMuscle Res Cell Motil. 2012 May;33(1):81. Carrrier, Lucie [corrected to Carrier, Lucie]. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/22057632)
- Marston SB. How do mutations in contractile proteins cause the primaryfamilial cardiomyopathies? J Cardiovasc Transl Res. 2011 Jun;4(3):245-55. doi:10.1007/s12265-011-9266-2. Epub 2011 Mar 22. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/21424860)

- Moller DV, Andersen PS, Hedley P, Ersboll MK, Bundgaard H, Moolman-Smook J, Christiansen M, Kober L. The role of sarcomere gene mutations in patients withidiopathic dilated cardiomyopathy. Eur J Hum Genet. 2009 Oct;17(10):1241-9. doi:10.1038/ejhg.2009.34. Epub 2009 Mar 18. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/19293840) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2986634/)
- Previs MJ, Beck Previs S, Gulick J, Robbins J, Warshaw DM. Molecular mechanicsof cardiac myosin-binding protein C in native thick filaments. Science. 2012 Sep7;337(6099):1215-8. doi: 10.1126/science.1223602. Epub 2012 Aug 23. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/22923435) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3561468/)
- Rodriguez JE, McCudden CR, Willis MS. Familial hypertrophic cardiomyopathy: basic concepts and future molecular diagnostics. Clin Biochem. 2009Jun;42(9):755-65. doi: 10.1016/j.clinbiochem.2009.01.020. Epub 2009 Feb 9. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/19318019)
- Waldmuller S, Erdmann J, Binner P, Gelbrich G, Pankuweit S, Geier C, Timmermann B, Haremza J, Perrot A, Scheer S, Wachter R, Schulze-Waltrup N, Dermintzoglou A, Schonberger J, Zeh W, Jurmann B, Brodherr T, Borgel J, Farr M, Milting H, Blankenfeldt W, Reinhardt R, Ozcelik C, Osterziel KJ, Loeffler M,Maisch B, Regitz-Zagrosek V, Schunkert H, Scheffold T; German Competence NetworkHeart Failure. Novel correlations between the genotype and the phenotype ofhypertrophic and dilated cardiomyopathy: results from the German CompetenceNetwork Heart Failure. Eur J Heart Fail. 2011 Nov;13(11):1185-92. doi:10.1093/eurjhf/hfr074. Epub 2011 Jul 12. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/21750094)

Genomic Location

The *MYBPC3* gene is found on chromosome 11 (https://medlineplus.gov/genetics/chromosome/11/).

Last updated June 1, 2017