Published on *My46* (https://www.my46.org) 10/16/2021

My46 Trait Profile

Catecholaminergic Polymorphic Ventricular Tachycardia

Catecholaminergic Polymorphic Ventricular Tachycardia is an inherited cardiac condition that causes abnormal heart rhythms (arrhythmias). It is caused by mutations in the RYR2 or CASQ2 genes that make proteins important for maintaining appropriate amounts of calcium in heart muscle cells.

Characteristics of Catecholaminergic Polymorphic Ventricular Tachycardia

Catecholaminergic Polymorphic Ventricular Tachycardia (CPVT) is a genetic condition that causes abnormal heart rhythms (arrhythmias) in a person whose heart structure is normal. When we experience physical activity or intense emotion, our body releases adrenaline, or a type of hormone known as a catecholamine. Adrenaline causes an increase in our heart rate. Individuals with CPVT have an abnormality in their hearts electrical system that prevents it from responding normally to adrenaline. This causes the heart to develop an arrhythmia in the lower chambers of the heart (ventricles) that is faster than normal. This arrhythmia can cause the heart to beat quickly and irregularly, preventing adequate blood flow to the brain and body. This can lead to symptoms such as dizzy spells, fainting, and sudden cardiac death. These symptoms occur most frequently when an individual is exercising or experiencing emotional stress. Typically, CPVT presents in childhood (around 8 to 10 years old), but it can be seen in individuals of all ages.

Diagnosis/Testing

About 50% of individuals with CPVT have a change or mutation in one of two genes: RYR2 and CASQ2 that each make a protein important for the management of calcium in our heart muscle cells (myocytes). The proteins made by these genes are important for maintaining the calcium levels in the myocytes, which is important for our heart muscle cells to contract with each heartbeat. Mutations in the RYR2 and CASQ2 genes are thought to interfere with how the heart rhythm responds when the body experiences a surge of adrenaline, leading to abnormal heart rhythms. It is important to note that genetic testing for CPVT may also include a third gene, called KCNJ2, which can cause a cardiac condition that can present similarly to CPVT.

Management/Surveillance

Management of CPVT includes regular follow-up with a cardiologist or electrophysiologist. Initial evaluation of a patient suspicious for CPVT typically includes an EKG (test that checks for problems with the electrical activity of the heart), an echocardiogram (an ultrasound of the heart), a Holter monitor (a wearable 24 hour EKG monitor), and most importantly, an exercise stress test (treadmill test).

Individuals with CPVT are often treated with a beta-blocker medication (used to control heart rate) and/or another anti-arrhythmic drug and lifestyle modification (i.e., avoiding competitive sports or situations that cause adrenaline surges). Some individuals with CPVT may also require device therapy through placement of an implantable cardioverter defibrillator (ICD; a small device placed under the skin that detects arrhythmias and keeps track of the heart rhythm). It can correct an abnormal beat in the heart.

Mode of inheritance

CPVT may be inherited in one of two patterns of inheritance: autosomal dominant and autosomal recessive.

Autosomal dominant inheritance:

In the majority of cases, CPVT is inherited in an autosomal dominant pattern. This means inheriting one RYR2 mutation is enough for an individual to be affected and show signs of CPVT. The mutation can be inherited from an affected parent or it can occur as a brand new mutation (de novo) in an affected child.

Autosomal recessive inheritance:

Rarely, CPVT is caused by mutations in the CASQ2 gene and is inherited in an autosomal recessive pattern. This means that an individual has to inherit two CASQ2 mutations (i.e., one from each parent) to be affected. If both parents are carriers of a CASQ2 mutation they have a 1 in 4 (25%) chance with each pregnancy of having a child with the CPVT.

Risk to family members

The risk to family members depends on the pattern of inheritance.

Autosomal dominant inheritance:

The risk to family members depends on whether or not the individual with CPVT has a parent affected with CPVT. If a parent also has the condition, the risk of having a child with CPVT is 50% with each pregnancy. If a parent does not have CPVT, the risk of other siblings being affected is very low.

Autosomal recessive inheritance:

Parents of a child with CPVT are carriers of CPVT. If a sibling of a child with CPVT is unaffected, he/she has a 2 in 3 (or 66%) chance of being a carrier of CPVT.

Special considerations

CPVT is a condition that exhibits both reduced penetrance and variable expression. Reduced penetrance means that not every person who inherits a gene mutation causing CPVT will definitely show symptoms of the condition in their lifetime. Variable expression indicates that even within the same family with multiple individuals who have CPVT, some relatives may have symptoms that are more or less severe than others.

Resources

Sudden Arrhythmia Death Syndromes
http://www.sads.org/About-SADS/CPVT
Genetics Home Reference: CPVT
http://ghr.nlm.nih.gov/condition/catecholaminergic-polymorphic-ventricular-tachycardia

References

Napolitano C, Priori SG, Bloise R. (Updated 7 February 2013). Catecholaminergic Polymorphic Ventricular Tachycardia. In: GeneReviews at GeneTests Medical Genetics Information Resource (database online). Copyright, University of Washington, Seattle. 1997-2013. Available at http://www.ncbi.nlm.nih.gov/books/NBK1289/. Accessed [06/17/2013].

Priori, SG. et al (2002)."Clinical and molecular characterization of patients with catecholaminergic polymorphic ventricular tachycardia." Circulation 106(1): 69-74.

Pflaumer, A. et al. (2012)."Guidelines for the diagnosis and management of Catecholaminergic Polymorphic Ventricular Tachycardia." Heart, Lung and Circulation 21(2): 96-100.

Created: 06/2013 **Created by:** Kate Orland, MS, CGC

Updated: mm/yyyy **Edited by:** Seema Jamal, MSc, LCGC