Catecholaminergic Polymorphic Ventricular Tachycardia

Subjects: Genetics & Heredity
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Catecholaminergic polymorphic ventricular tachycardia (CPVT) is a condition characterized by an abnormal heart rhythm (arrhythmia).

Keywords: genetic conditions

1. Introduction

As the heart rate increases in response to physical activity or emotional stress, it can trigger an abnormally fast heartbeat called ventricular tachycardia. Episodes of ventricular tachycardia can cause light-headedness, dizziness, and fainting (syncope). In people with CPVT, these episodes typically begin in childhood.

If CPVT is not recognized and treated, an episode of ventricular tachycardia may cause the heart to stop beating (cardiac arrest), leading to sudden death. Researchers suspect that CPVT may be a significant cause of sudden death in children and young adults without recognized heart abnormalities.

2. Frequency

The prevalence of CPVT is estimated to be about 1 in 10,000 people. However, the true prevalence of this condition is unknown.

3. Causes

CPVT most commonly results from mutations in two genes, *RYR2* and *CASQ2*. *RYR2* gene mutations cause about half of all cases, while mutations in the *CASQ2* gene account for up to 5 percent of cases. Mutations in other genes are rare causes of the condition.

The *RYR2* and *CASQ2* genes provide instructions for making proteins that help maintain a regular heartbeat. For the heart to beat normally, heart muscle cells called myocytes must tense (contract) and relax in a coordinated way. Both the RYR2 and CASQ2 proteins are involved in the movement of calcium within myocytes, which is critical for the regular contraction of these cells.

Mutations in either the *RYR2* or *CASQ2* gene disrupt the handling of calcium within myocytes, which interferes with the coordination of contraction and relaxation of the heart, particularly during exercise or emotional stress. Impaired calcium regulation in the heart can lead to ventricular tachycardia in people with CPVT.

Similarly, other genes involved in CPVT play roles in calcium regulation in myocytes. Mutations in these genes also disrupt the normal movement of calcium inside these cells, impairing the coordination of heart beats.

3.1. The Genes Associated with Catecholaminergic Polymorphic Ventricular Tachycardia

- CASQ2
- RYR2

4. Inheritance

When CPVT results from mutations in the *RYR2* gene, it follows an autosomal dominant inheritance pattern, which means one copy of the altered gene in each cell is sufficient to cause the disorder. In about half of cases, an affected person inherits an *RYR2* gene mutation from one affected parent. The remaining cases result from new (de novo) mutations in the *RYR2* gene that occur during the formation of reproductive cells (eggs or sperm) in an affected individual's parent or in early embryonic development. These cases occur in people with no history of the disorder in their family.

When CPVT is caused by mutations in the *CASQ2* gene, the condition almost always has an autosomal recessive pattern of inheritance. Autosomal recessive inheritance means both copies of the gene in each cell have mutations. The parents of an individual with an autosomal recessive condition each carry one copy of the mutated gene, but they typically do not show signs and symptoms of the condition. Very rarely, *CASQ2*-related CPVT may follow an autosomal dominant pattern of inheritance.

When caused by mutations in other genes, CPVT can be inherited in an autosomal dominant or autosomal recessive pattern.

5. Other Names for This Condition

- bidirectional tachycardia induced by catecholamines
- catecholamine-induced polymorphic ventricular tachycardia
- CPVT
- familial polymorphic ventricular tachycardia
- FPVT

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