

Potential Causes of Sudden Cardiac Death in Children

When sudden death occurs in children, adolescents and younger adults, other heart abnormalities are more likely causes. These causes fall into three main categories and possible diagnoses include:

Structural/Functional:

- Hypertrophic Cardiomyopathy ♥
- Coronary Artery Anomalies
- Aortic Rupture/ Marfan Syndrome ♥
- Dilated Cardiomyopathy ♥
- Myocarditis/ Endocarditis
- Left Ventricular Outflow Tract Obstruction
- Mitral Valve Prolapse
- Coronary Artery Atherosclerotic Heart Disease ♥
- Arrhythmogenic Right Ventricular Cardiomyopathy ♥
- Post-Operative Congenital Heart Disease

Electrical:

- Long QT Syndrome ♥
- Short QT Syndrome ♥
- Wolff-Parkinson-White Syndrome
- Brugada Syndrome ♥
- Congenital Heart Block
- Catecholaminergic Ventricular Tachycardia ♥

Other:

- Primary Pulmonary Hypertension ♥
- Drugs/Stimulants
- Commotio Cordis

♥ indicates familial or genetic causes

Definitions

Potential Causes of Sudden Cardiac Death

Any of these conditions can result in an unstable and ineffective heart rhythm, ventricular fibrillation, which leads to sudden cardiac arrest.

Functional

1. Hypertrophic cardiomyopathy (HCM) occurs when the heart muscle becomes too thick to function properly. The thickening is often not symmetrical, affecting one part of the heart more than others. It may interfere with the functioning of the heart by reducing the size of the ventricular chamber or decreasing the ability of the valves to work properly.

HCM is usually an inherited disorder, the consequence of several defects in the genes controlling heart muscle growth. The abnormal muscle growth usually occurs during periods of rapid growth, typically during adolescence. Younger people are likely to have a more severe form of the disease, but HCM may be diagnosed in people of all ages. HCM is reportedly the most common cause of sudden cardiac death in people less than 35 years old.

2. Coronary artery anomalies can be congenital or acquired (e.g. Kawasaki's disease), and can predispose the patient to myocardial ischemia and sudden death. This risk seems to be highest in children and adolescents.

3. Marfan Syndrome is a genetic disorder that affects the body's connective tissue, especially the eyes, skeleton, blood vessels and heart. In the heart, the aorta can become enlarged and prone to rupture.

4. Dilated cardiomyopathy is the most common of the heart muscle diseases, and can be found at any age, including childhood. The heart becomes enlarged and less efficient and arrhythmias can occur. Poor exercise tolerance and shortness of breath with exercise can be signs indicating a need for further evaluation.

5. Myocarditis is an inflammation of the heart muscle and can be caused by viral, bacterial or fungal infection; rheumatic fever; tuberculosis or toxic drug poisoning.

6. Left ventricular outflow tract obstruction can occur below the aortic valve, at the valve or above the valve. It usually causes progressive symptoms and can happen with other heart conditions.

7. Mitral valve prolapse is a disorder in which the mitral valve doesn't close properly allowing the potential leakage of blood from the left ventricle back into the left atrium. Often asymptomatic, it also can feature mild intermittent symptoms of a racing heartbeat, dizziness or lightheadedness, shortness of breath and fatigue. Less commonly symptoms include severe regurgitation of blood into the atrium, putting the patient at risk of bacterial endocarditis or congestive heart failure. Irregular heart rhythms are also rare complications, and sudden death has been associated rarely.

8. Coronary artery atherosclerotic disease, which blocks and stiffens the blood vessels of the heart itself is seen more commonly in adults and can lead to areas of heart damage and irregular heart rhythms, including ventricular fibrillation.

9. Arrhythmogenic right ventricular cardiomyopathy is another inherited disease that can cause sudden deaths in young people. Many of these present with exercise-associated syncope or fainting. The right ventricular muscle is gradually replaced with fatty tissue.

Electrical

10. Long QT syndrome is a genetic condition affecting the electrical system of the heart.

Individuals with this condition are at risk for serious heart rhythm abnormalities that can lead to loss of consciousness and cardiac arrest. It is usually recognized by an abnormality on the electrocardiogram (ECG) known as prolonged QT interval and often can be treated medically after diagnosis.

11. Wolff-Parkinson-White syndrome is a type of supraventricular tachycardia in which an extra electrical pathway exists between the atria and the ventricles, leading to arrhythmias.

12. Brugada syndrome is another genetic condition that affects the electrical system of the heart and may be evident on ECG in some cases. Patients, most often young adults in the second and third decades, are at risk for sudden cardiac death.

13. Congenital heart block is complete failure of electrical conduction from atria to ventricles, disrupting the normal electrical pathways in the heart and can lead to dysrhythmias and sudden death.

14. Catecholaminergic ventricular tachycardia is a genetic condition affecting the electrical system of the heart. There are usually no specific resting ECG changes, but affected patients are prone to very fast heart rhythms during exercise and sudden death.

15. Short QT syndrome is a familial disease that can lead to syncope, palpitations and increased vulnerability to ventricular fibrillation and sudden death.

16. Postoperative congenital heart disease in the older child or young adult can result in sudden death due to coronary ischemia, dysrhythmias, sepsis, thrombotic events or pulmonary hypertensive crisis.

Other/Acquired

17. Comotio Cordis is a life-threatening dysrhythmia caused by a direct, non-penetrating, often low-impact blow to the chest at a critical time in the cardiac cycle, most often during participation in sports such as baseball, hockey, lacrosse and softball. Approximately one third of the reported cases occurred outside of sporting activities, including intentional chest blows during fighting or child abuse, or even impact by snowballs or hollow plastic toys. The impact causes a sudden disturbance of cardiac rhythm, most commonly ventricular fibrillation. Early resuscitation and defibrillation are critical to survival.

18. Drugs and stimulants such as cocaine, ephedra, heroin, marijuana, amphetamines, ecstasy, inhalants, gasoline, glue and emetine can cause sudden death in users.

19. Pulmonary hypertension can be a primary condition or associated secondarily with congenital heart defects. One of the complications can be an irregular heart rhythm, including ventricular fibrillation, leading to sudden death.