

Understanding Cardiac Arrhythmias

Each year, sudden cardiac death affects more than 325,000 people in the United States alone. Cardiac arrhythmias are responsible for many of these episodes of sudden death. The Cardiac Arrhythmias Research and Education (C.A.R.E.) Foundation, Inc. has the mission to formulate, promote and lead initiatives to prevent sudden cardiac death due to acquired and heritable heart rhythm disorders by:

- **Advancing relevant and comprehensive scientific research and clinical trials.**
- **Educating patients, the public and healthcare professionals to increase awareness.**
- **Advocating for strategies to identify, protect and support at-risk individuals and their families.**

What are cardiac arrhythmias?

Cardiac arrhythmias are disturbances in the heart's natural rhythm. These disturbances are caused by disruption in the normal conduction of electrical signals within the heart. For various reasons, electrical signals may be detoured, slowed or blocked while traveling through certain parts of the heart. This can cause the heart's natural rhythm to speed up or slow down, affecting the flow of blood to the body's internal organs. There are many different types of arrhythmias.

What causes arrhythmias?

There are many known causes of arrhythmias, including scars in the heart muscle from a previous myocardial infarction (heart attack), lack of blood to the heart muscle from atherosclerosis, abnormalities in the electrical conduction system or extra electrical connections within the heart. Other known causes include abnormalities in the heart's muscle or electrical system and the effects of certain medications.

The underlying mechanisms of certain arrhythmias remain unresolved. For example, heritable disorders can contribute to the onset of arrhythmias in several ways. First, single gene mutations may be directly responsible for the abnormality that causes the arrhythmia, such as in Long QT Syndrome.

Second, heritable structural abnormalities may cause arrhythmias, such as in familial Hypertrophic Cardiomyopathy or familial mitral valve prolapse. Finally, certain genetic disorders may lead to premature coronary artery disease or cardiomyopathy, which may cause arrhythmias.

What are common symptoms of arrhythmias?

Depending on the type of arrhythmia, the symptoms will vary. Some arrhythmias may be brief, lasting only a few moments, while others may be longer, causing sustained episodes. Arrhythmias may cause the heart to pump less effectively and may cause dizziness, chest discomfort, shortness of breath or loss of consciousness. While many arrhythmias are not life-threatening, the most dangerous types can lead to sudden cardiac arrest and death.

Although the severity of symptoms is usually related to the seriousness of the arrhythmia, there are situations in which symptoms have not occurred but the potential for serious arrhythmias still exists.

What is being done to study arrhythmias?

Significant breakthroughs have occurred in the past several years that have greatly increased the understanding of the genetic basis of certain forms of sudden cardiac death. These breakthroughs form the foundation on which new testing techniques and treatments are being made available.

Heritable rhythm disorders, such as Long QT Syndrome, Hypertrophic Cardiomyopathy and Brugada Syndrome, are known as autosomal dominant genetic variations, which means that the child of a person with the gene for one of those disorders has a 50:50 chance of inheriting the same genetic mutation.

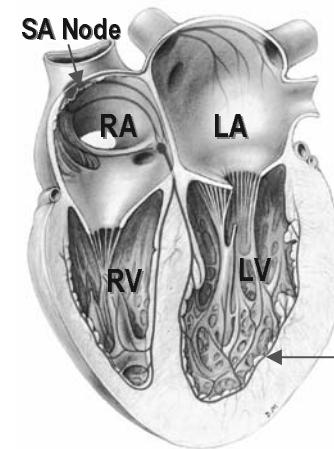
Talk to your doctor regarding the feasibility of genetic testing for heritable rhythm disorders. At this time, commercially available genetic tests exist for Long QT Syndrome and Brugada Syndrome (visit www.familion.com), and Hypertrophic Cardiomyopathy (visit www.hpcgg.org).

Where can I learn more about arrhythmias?

The best person to talk to is a board-certified cardiologist or electrophysiologist. These specialists can evaluate symptoms and family histories and make recommendations based on their findings. Visit www.longqt.org or call CARE at **800-404-9500** for more information.

Normal Heart Rhythm

A normal heartbeat is the result of the heart's own rhythm working together with the nervous system to meet the body's needs.



The heart's electrical system consists of a natural pacemaker, the Sinus (SA) Node, where each heartbeat originates and a network of specialized conduction pathways called the Purkinje fibers. These fibers transmit electrical signals throughout the heart's chambers, causing them to contract in an

orderly pattern. This results in a smooth flow of blood into and out of the heart.

Examples of Life-Threatening Arrhythmias

With cardiac arrhythmias, the orderly conduction of electrical signals is disrupted. This affects the heart's ability to pump blood to the rest of the body.

During ventricular tachycardia (VT) the electrical signal may be interrupted after it travels into the heart's lower chambers (right (RV) and left (LV) ventricles). The disrupted signal may move erratically through the muscle, causing the heart to contract unusually fast. These rapid contractions prevent the heart from filling adequately with blood between beats. VT may cause dizziness and fainting and may be life-threatening if not treated properly.

In ventricular fibrillation (VF), the electrical signal moves chaotically throughout the chambers. This causes the heart muscle to quiver. Since the heart is not contracting, blood is not being pumped properly, and the body is quickly starved of oxygen. This can result in sudden cardiac death if not treated immediately.

The only effective treatment for a person in VF is to deliver an electrical shock to the heart muscle with a defibrillator. An external defibrillator may be automated (AED) or manual. Patients at high risk for VT and VF may also have an implanted cardioverter defibrillator (ICD).

Inherited Heart Rhythm Disorders

Long QT Syndrome (LQTS) is a disorder characterized by abnormal electrical activity in the ventricles, which causes the recharging (repolarization) of the heart to be slower than it should be. The QT interval is part of the ECG signal and indicates the time it takes for the heart's electrical system to recharge. When the QT interval is prolonged, the ventricles are more vulnerable to arrhythmias.

Symptoms of LQTS include fainting (syncope), seizures, and sudden unexplained death. Triggers that may lead to symptoms and arrhythmias include intense physical activity, strong emotional experiences and stressors, sounds that startle such as alarms, telephone, doorbells, car horns.

LQTS is typically diagnosed on an electrocardiogram (ECG) during evaluation of unexplained fainting or as part of a family screening. Genetic testing may also identify those individuals with LQTS and the specific type of mutation.

A number of prescription and over-the-counter (OTC) medications can prolong the QT interval and should be avoided by those with LQTS. Visit www.qtdrugs.org for more information on drugs to avoid.

The majority of patients with LQTS are treated effectively with beta blocker medications. Depending on the severity of symptoms, family history of sudden death, and genetic type of LQTS, some patients may require an ICD to protect them from life-threatening arrhythmias.

For more information about LQTS, talk to your doctor, contact C.A.R.E. and visit www.longqt.org.

Brugada Syndrome (BrS) is a cardiac disorder that causes arrhythmias in the ventricles, including VT and life-threatening VF. Patients with BrS may have symptoms of fainting (syncope) and sudden cardiac arrest (SCA). These symptoms occur most commonly at rest or during sleep.

Brugada Syndrome is often diagnosed from an ECG. If necessary, a pharmacologic test may be administered to provoke the arrhythmia and uncover the syndrome. Genetic testing is also available to identify those individuals with the Brugada Syndrome. At this time there is no known medication to prevent arrhythmias due to BrS. An implantable cardioverter defibrillator (ICD) is the only proven effective treatment.

For more information, talk to your doctor and visit www.brugada.org or www.mmri.edu.

Inherited Heart Rhythm Disorders (continued)

Arrhythmogenic Right Ventricular Dysplasia (ARVD) is a rare disorder affecting the right ventricle (RV), in which some of the normal heart muscle cells are replaced by fatty material and scar tissue.

Symptoms in affected persons are caused by arrhythmias originating in the RV. These arrhythmias range from isolated extra heart beats which may cause palpitations to life-threatening arrhythmias of sustained VT and VF

ARVD usually becomes evident in adolescence or early adulthood. Though sometimes difficult to diagnose, clues to ARVD may be found in abnormalities on an ECG. However, the diagnosis should be confirmed by ultrasound examination of the heart (echocardiogram), magnetic resonance imaging (MRI) or injection of contrast dye into the right ventricle during an angiogram. Occasionally a heart muscle biopsy is required.

ARVD should be considered in young patients without known heart disease with unexplained arrhythmias, palpitations or fainting episodes. Some patients may be effectively treated with anti-arrhythmic medications, while those at high risk may need an implantable cardioverter defibrillator (ICD).

For more information about ARVD, talk to your doctor, contact C.A.R.E., and visit www.arvd.com and www.arvd.org.

Hypertrophic Cardiomyopathy (HCM) is a heart muscle disease, characterized by an abnormal thickening of the left ventricle (LV). HCM is the most common cause of sudden death in otherwise healthy young people such as athletes. Arrhythmias are common and range from occasional extra beats to more serious life-threatening forms.

Diagnosis of HCM usually occurs during evaluation of symptoms such as shortness of breath, palpitations, chest pain or fainting episodes. The diagnosis may be determined by the presence of a heart murmur or abnormal ECG, and is confirmed by an echocardiogram. Medical therapy is the primary treatment, although some patients may require an ICD.

For more information about HCM, talk to your doctor, contact C.A.R.E., and visit www.4hcm.org.



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