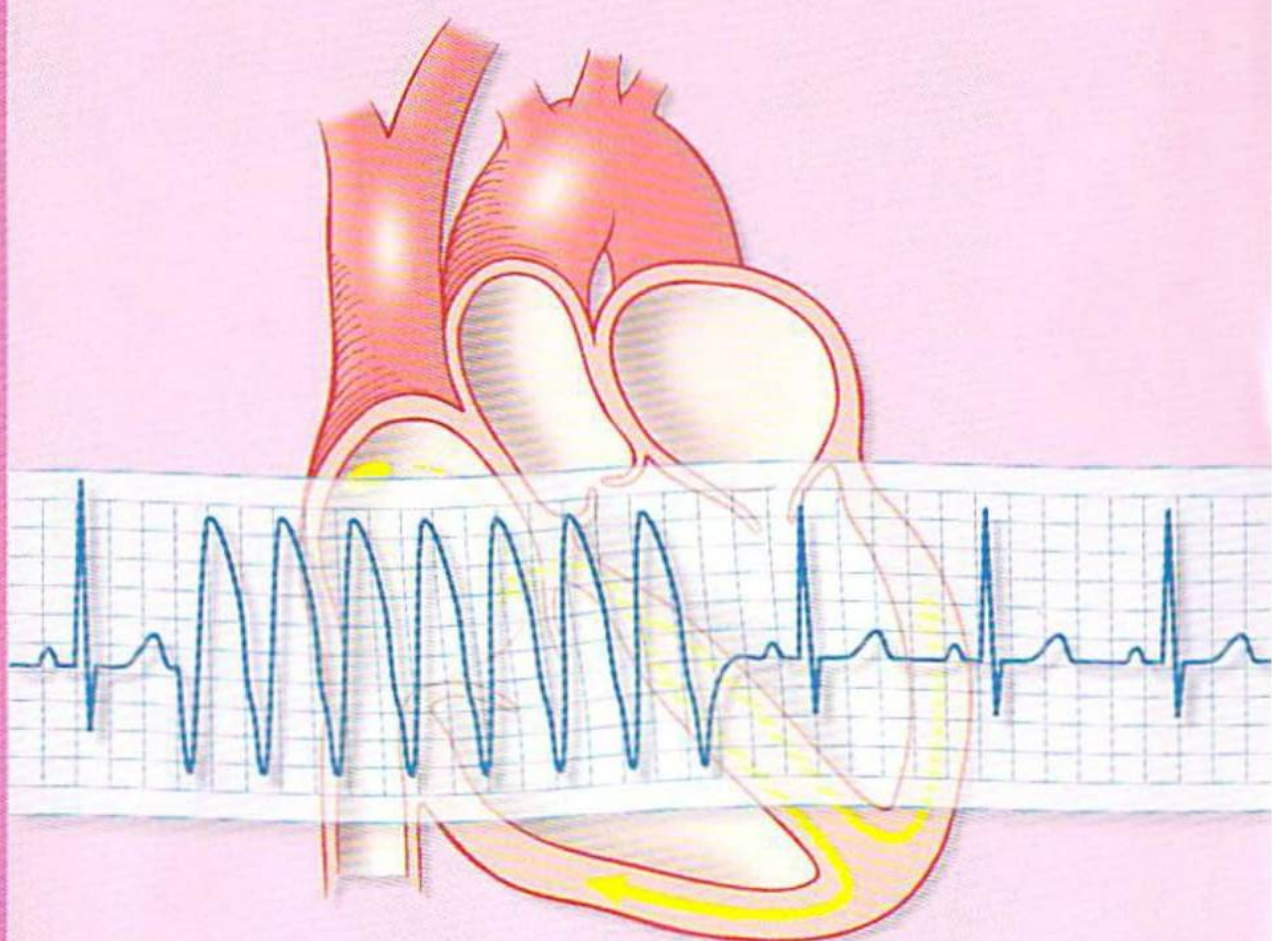



# ***Arrhythmias***



***A Patient's Guide***

*This booklet is not intended to replace professional medical care. Only your doctor can diagnose and treat medical problems.*



Perhaps you have been told by your doctor that you have an arrhythmia. Now, you probably have some questions and concerns about it. This booklet may help answer many of your questions.

### **What Is an Arrhythmia?**

An **arrhythmia** is a change in either the speed or the pattern of your heartbeat, causing an abnormal heart rhythm. During an arrhythmia, your heart may beat too fast, too slowly, or irregularly.

An arrhythmia may be felt as a skipping or fluttering sensation in the chest (palpitations). It may also cause light-headedness, a fainting spell, chest pain, or shortness of breath. Some arrhythmias, however, may go unnoticed.

### **How Serious Are Arrhythmias?**

How serious your arrhythmia is depends on the type of arrhythmia you have, how often it occurs, and whether there are other problems with your heart.

Most people with arrhythmias have nothing to fear. They do not need lots of tests or special treatments for their condition.

For a small number of people, however, arrhythmias can be serious. The heart may beat too slowly or too fast to pump enough blood to the body, or there may be a threat to the person's life.

## How the Heart Works

Before discussing the details of arrhythmias, it helps to understand how the heart works.

### The Heart as a Pump

The heart is a muscular, hollow organ that constantly pumps blood throughout the body.

The heart is made up of four chambers. There are two chambers on the left side and two on the right. The upper chamber on each side, called an **atrium**, receives and collects blood. The lower chamber on each side, called a **ventricle**, pumps blood.

The four heart chambers work together to contract (squeeze) and pump blood. As it circulates, blood delivers oxygen and nutrients throughout the body.

### The Heart's Electrical System

The heart's electrical system creates and conducts electrical impulses that tell the chambers to contract and pump blood.

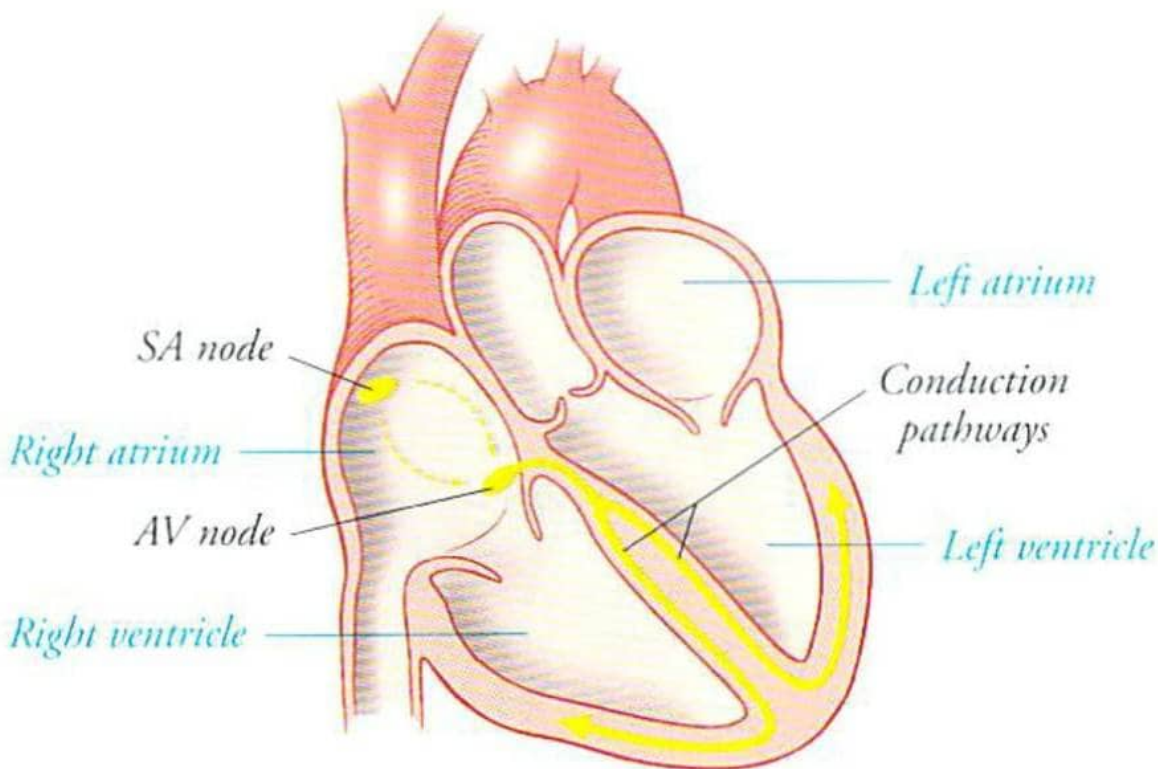
The heart's electrical impulses normally begin at the sino-atrial node, or **SA node**, a cluster of specialized cells located at the top of the right atrium. The SA node functions as the heart's "natural pacemaker," producing electrical impulses at regular intervals and setting the proper rhythm for the heartbeat.

Each electrical impulse travels a set path and spreads throughout the atria (plural of atrium), causing them to contract and pump blood into the ventricles.

From the atria, the electrical impulse reaches the atrio-ventricular node, or **AV node**, which is located between the atria and the ventricles. The AV node functions like an electrical “gatekeeper,” slowing down each electrical impulse before it passes through to the ventricles.

The impulse then travels to the ventricles through **conduction pathways** made of specialized muscle fibers. The impulse stimulates the ventricles, causing them to contract and pump blood.

At rest, the SA node normally initiates 60 to 80 beats a minute. With activity or excitement, the body needs greater blood circulation. A healthy SA node responds to these changes in the body by increasing the heart rate (speed) accordingly.



## How Doctors Diagnose Arrhythmias

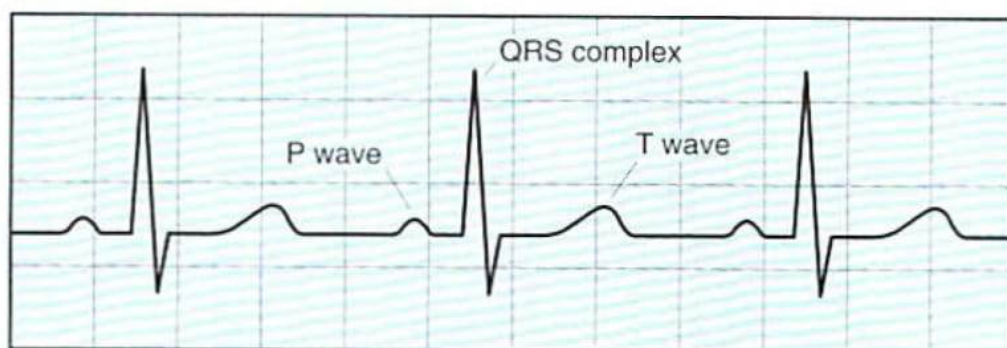
To help diagnose your arrhythmia, your doctor will take a medical history. You'll likely be asked when your symptoms started, how often you notice them, and how long they usually last.

As part of your physical exam, your doctor will check your **pulse**. Checking your pulse tells the doctor how fast your heart is beating and whether your heart rhythm is regular or not.

In addition, diagnostic tests may be done to check for an arrhythmia or help determine its cause.

■ An **electrocardiogram (ECG)** is a simple test that records the electrical activity of your heart. Several electrodes (small pads) are placed on your chest, arms, and legs. The heart's electrical impulses cause a needle to trace the heartbeat as a wavy line.

The ECG tracing is a series of waves that represent the electrical events in the heart.

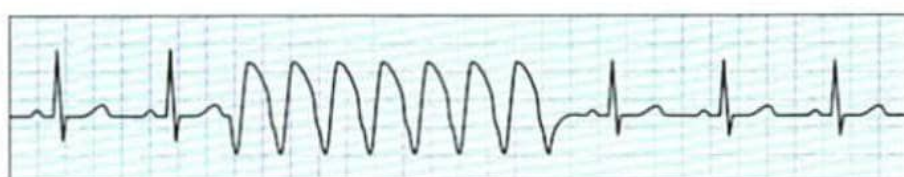


*The small initial wave, the P wave, represents the electrical stimulation of the atria. Next comes the QRS complex, which represents the stimulation of the ventricles. Finally, the T wave represents the period when the ventricles “recharge” their electricity so they can be stimulated again.*

By carefully examining the sequence of events on the ECG, doctors are able to diagnose arrhythmias as well as other heart conditions.



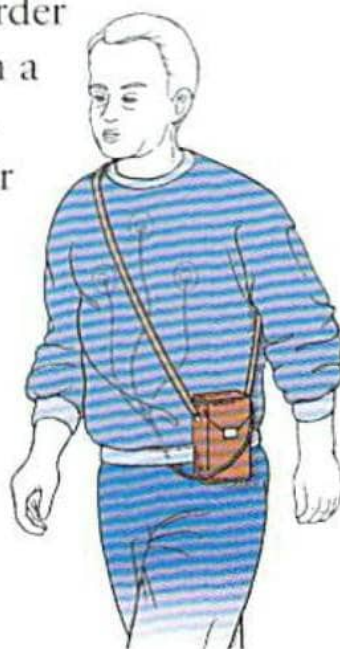
*An ECG recording of a normal heart rhythm at rest.*



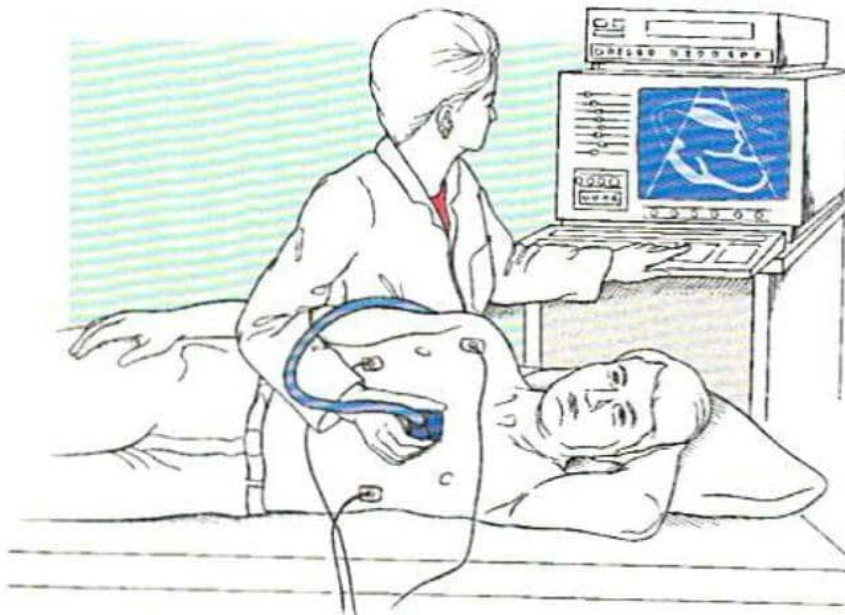
*An ECG recording of an arrhythmia.*

Quite often, an arrhythmia will not occur during the brief period (less than a minute) of actual ECG recording. If your doctor suspects that you have an arrhythmia, more diagnostic tests may be necessary.

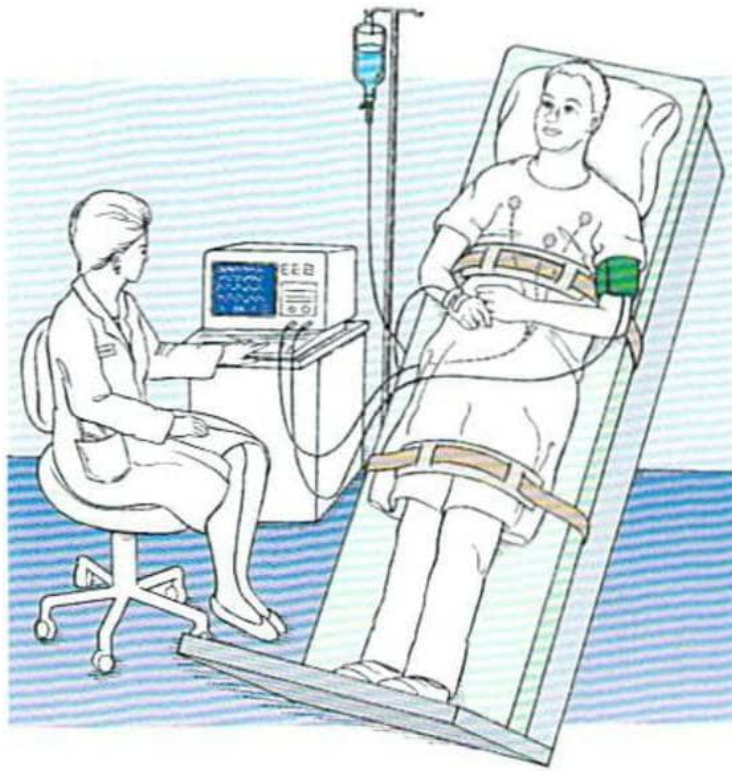
■ **Holter monitoring** is a continuous recording of your ECG, usually for 24 hours, while you go about your normal daily activities. The recorder is small and portable, and is worn on a strap over the shoulder or around the waist. Holter monitoring is useful for detecting arrhythmias that may not appear during a resting ECG at the doctor's office.



- An **event recorder** is similar to a Holter monitor, except that it is worn over a period of days or weeks. When symptoms occur, you press a button to activate the recorder, and the device records several minutes of ECG. The event recorder helps detect arrhythmias that occur infrequently.
- An **exercise ECG test** (treadmill) allows doctors to record an ECG during the stress of exercise. It can help bring on arrhythmias that may not occur during a resting ECG.
- An **echocardiogram** uses ultrasound waves to create an image of the heart and the pattern of blood flow through it. It is a safe, painless test that helps doctors diagnose a variety of heart problems, such as defective heart valves or a weakened heart. The echocardiogram can help doctors determine whether your arrhythmia is linked to a heart problem.





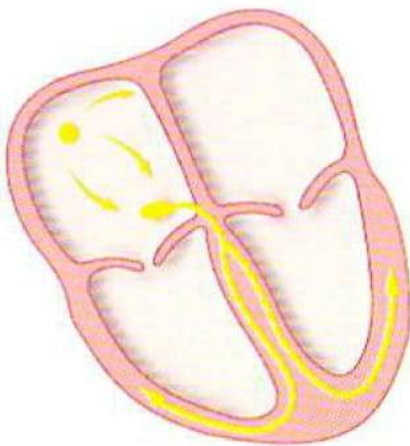


- In patients who have had fainting spells (syncope), a **tilt table test** can help determine how the body responds to changes in body position. The patient lies on a table that can be moved to a nearly upright position while symptoms, blood pressure, and ECG are continuously monitored.
- If these basic tests do not give doctors all of the information they need, an electrophysiology study, or **EP study**, may be done. During the test, doctors insert electrode catheters (long, flexible wires) into veins and guide them into the heart. The procedure helps locate abnormal sites inside the heart that may be causing serious arrhythmias.

## Understanding Arrhythmias

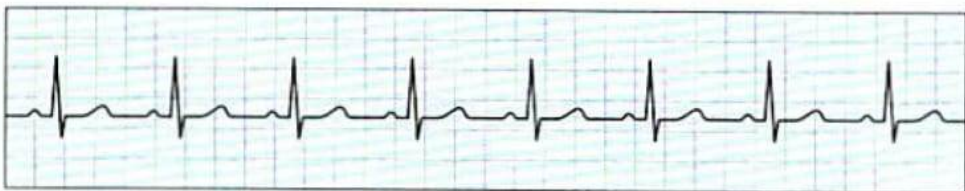
Normally, the SA node sets the pace for the heartbeat (see pages 4 and 5). The atria contract first, squeezing blood into the ventricles. A fraction of a second later, the ventricles contract and pump blood to the body. This timing sequence ensures that the atria and the ventricles beat “in sync.”

The *speed* at which the heart beats is called the **heart rate**, and the *pattern* of the heartbeat is the **rhythm**. On an ECG tracing, the heart’s normal rhythm at rest is called **normal sinus rhythm**. During normal sinus rhythm, the heart rate is between 60 to 100 beats per minute and the rhythm is regular.



### *Normal sinus rhythm*

*Each heartbeat starts as an electrical impulse in the SA node. The impulse travels to the AV node, then down the conduction pathway to the ventricles. On the ECG, the heart rate is between 60 and 100 beats per minute and the rhythm is regular.*

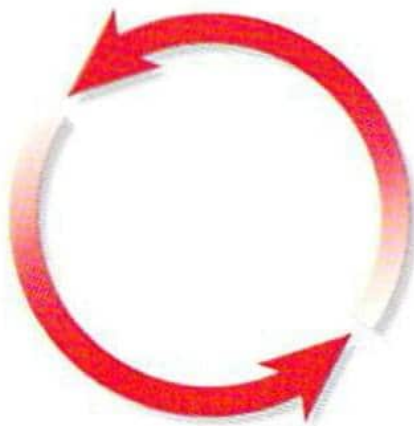


During an arrhythmia, there is a change in either the rate or pattern of the heartbeat. The heart may beat too fast (over 100 beats per minute), resulting in **tachycardia**; it may beat too slowly (under 60 beats per minute), resulting in **bradycardia**; or the rhythm may become irregular or erratic.

## Understanding Tachycardias

Tachycardias (rapid heart rhythms) may start in the atria, AV node, or ventricles. Because the ventricles do most of the pumping, tachycardias that start in the ventricles are usually more serious.

Most, but not all, cases of tachycardia occur when an abnormal extra pathway, or **re-entry circuit**, exists in the atria, AV node, or ventricles. If an electrical impulse enters this pathway, it may start traveling in a circular pattern. This can cause the heart to contract each time the electrical impulse cycles through the pathway, resulting in a very rapid heartbeat.



### *Re-entry circuit*

*An electrical impulse has entered the abnormal pathway. If it continues traveling in a circular pattern, it can cause a very rapid heartbeat.*

## Understanding Bradycardias

Bradycardias (slow heart rhythms) usually occur for one of two reasons: the SA node does not produce normal electrical impulses, or the conduction pathway does not conduct electrical impulses from the atria to the ventricles. As a result, the heart may beat too slowly or may pause too long between beats.

## **What Causes Arrhythmias?**

Arrhythmias are more common in people with heart disease, especially coronary heart disease, heart valve disease, or a weakened heart. High blood pressure, lung disease, or an overactive thyroid gland can also cause arrhythmias.

But having an arrhythmia does not always mean that a person has heart disease. In fact, arrhythmias may occur in people with an otherwise normal heart. Other factors that can bring on arrhythmias include caffeine, alcohol, tobacco, and stress.

## **Symptoms of Arrhythmias**

Arrhythmias can cause palpitations, light-headedness, fainting spells, or other symptoms.

Keep in mind, however, that having these symptoms does not always mean that you have an arrhythmia. On the other hand, a serious or even life-threatening arrhythmia may cause no symptoms at all.

### ■ *Palpitations*

Normally, we're not aware of our heart beating inside our chest. However, when the heart starts beating too fast, too slowly, or irregularly, we may become aware of it. This uncomfortable awareness of the heartbeat is called palpitations.

Most commonly, people describe their palpitations as "thumping in the chest," "fluttering in the chest," "a racing heart," "flip-flops," or "skipping a heartbeat."

### ■ *Light-headedness (Near-Syncope)*

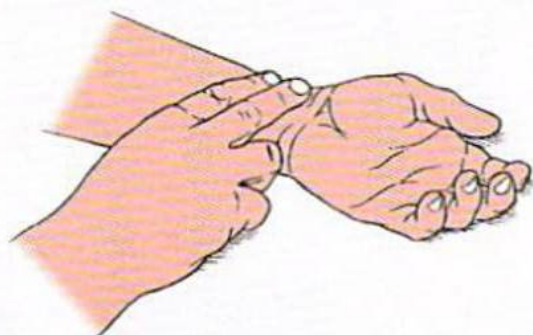
Near-syncope refers to a situation in which a person *suddenly* feels dizzy, light-headed, and weak, as if about to pass out. The sensation usually lasts for only a few seconds.

### ■ *Fainting Spell (Syncope)*

Syncope is the medical term for a fainting spell, or sudden loss of consciousness. Syncope may result when the heartbeat is either too slow or too rapid. The person passes out because the heart is not able to pump enough blood and oxygen to the brain.

### ■ *Other Symptoms*

Arrhythmias may also cause chest pain and shortness of breath. These symptoms usually occur because a rapid rhythm has put a strain on the heart.



*Taking your pulse can help you determine how fast your heart is beating, and whether the beat is regular or not. Place two fingers on the underside of your wrist, just below the base of the thumb. Count the beats for 15 seconds, then multiply by 4. This will give you the heart rate (per minute).*

## Common Arrhythmias

Arrhythmias can be divided into two basic categories: supraventricular and ventricular. **Supraventricular arrhythmias** start “above the ventricles,” that is, in the atria or AV node. **Ventricular arrhythmias** start in the ventricles (the heart’s lower chambers).

Arrhythmias are further defined by the speed of the heartbeat. As we’ve seen, fast heart rhythms are called tachycardias, slow ones are called bradycardias.

### Supraventricular Arrhythmias

Here’s is a brief description of the most common types of supraventricular arrhythmias.

#### ■ *Premature Atrial Contractions*

Premature atrial contractions (**PACs**) are atrial beats that occur earlier than expected and briefly interrupt the heart rhythm.

PACs are very common. In fact, almost everyone has them at least once in a while. Factors that may make PACs worse include caffeine, alcohol, tobacco, stress, and lack of sleep.

In most cases, PACs do not cause any symptoms. Some people may feel palpitations, usually a sensation of “skipped beats.”

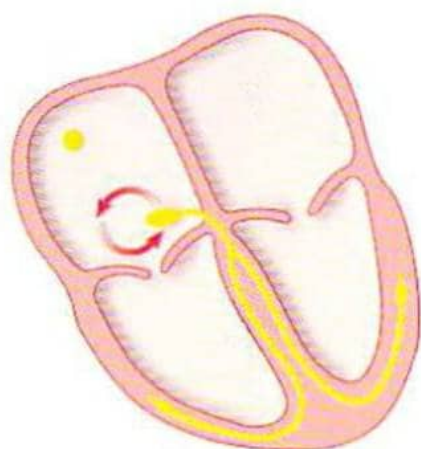
PACs are harmless and usually do not require special treatment. If symptoms occur, a few lifestyle changes may be all that’s needed, such as avoiding caffeine, reducing stress, or getting enough sleep. If symptoms persist, doctors may prescribe medications.

## ■ *Supraventricular Tachycardia*

Supraventricular tachycardia (**SVT**) is a series of very rapid heartbeats that start in the atria or AV node.

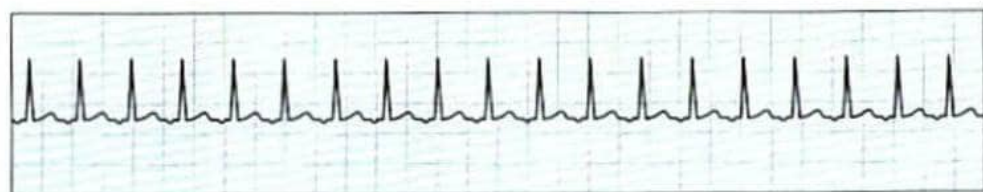
An episode, or “attack,” of SVT is often **paroxysmal**, meaning that it starts suddenly and stops suddenly. An episode can last from less than a minute to as long as several hours. It can occur frequently, sometimes several times a day, or infrequently.

**AV nodal re-entrant tachycardia** is by far the most common type of paroxysmal SVT. In this condition, a re-entry circuit (see page 11) that exists in or next to the AV node causes attacks of tachycardia.



### *AV nodal re-entrant tachycardia*

*An electrical impulse has entered the extra pathway in or next to the AV node. The impulse travels in a circular pattern and causes the heart to contract with each cycle. The ECG shows a very rapid heart rate and a perfectly regular rhythm.*



An attack of SVT may cause palpitations (a sensation of a “racing heart”), dizziness, shortness of breath, or chest pain. While such attacks may be distressing, they are seldom life-threatening.

SVT may be associated with various types of heart disease, but it is commonly seen in people who are otherwise healthy. Factors that can bring on attacks of SVT include caffeine, alcohol, and stress.

Episodes of SVT often can be stopped, or “broken,” by stimulating the vagus nerve (one of the nerves that help regulate the heart rate). Common ways to do this include having a person bear down (as though straining at a bowel movement) or splashing cold water on his or her face.

If this doesn't work, doctors can stop an attack of SVT in several ways. They may rub the person's neck just below the angle of the jaw (which stimulates a sensitive area on the carotid artery called the carotid sinus). If this fails, doctors may inject a dose of drugs (such as adenosine) into a vein.

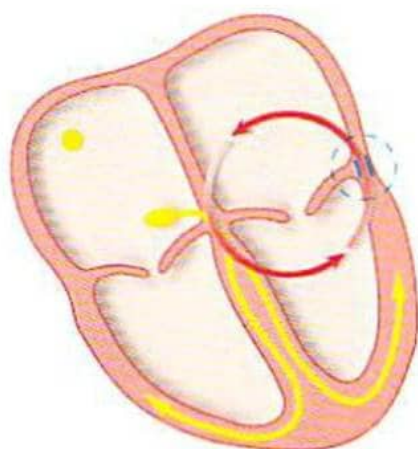
If the attacks are frequent or if the symptoms are very annoying, doctors may prescribe antiarrhythmic drugs (see page 26) to help prevent attacks.

If drugs do not work or produce serious side effects, doctors may recommend catheter ablation (see page 28) to destroy the extra pathway.



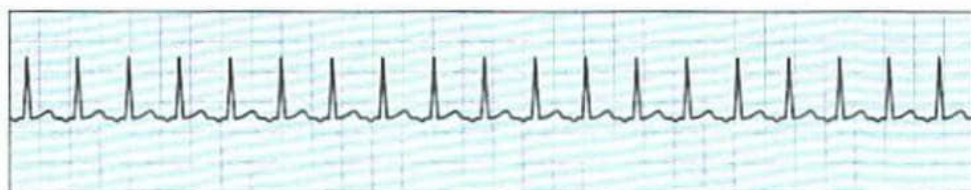
### ■ *Accessory Pathway Tachycardia*

In this condition, often called Wolff-Parkinson-White (**WPW**) Syndrome, an abnormal “bridge” of tissue, called an **accessory pathway**, connects the atria and ventricles. This extra pathway may allow very rapid heart rhythms to occur.



#### *Accessory Pathway Tachycardia*

*An impulse has traveled down the AV node to the ventricles, and then up through the accessory pathway to the atria. If the impulse continues to travel in a circular pattern, it can result in an extremely rapid, sometimes dangerous, heart rhythm. The ECG shows a very rapid, regular rhythm.*



Patients with WPW may have recurrent attacks of SVT (see page 15). At times, the heart rhythm can be extremely rapid and potentially life-threatening. However, many patients with WPW have infrequent attacks or no symptoms at all.

In patients with WPW and recurrent SVT, doctors often recommend catheter ablation (see page 28) to destroy the bridge of tissue containing the accessory pathway. Catheter ablation provides a permanent cure in most cases.

## ■ *Atrial Fibrillation*

In atrial fibrillation, many tiny waves, or wavelets, of electrical activity continuously flow across the atria. These wavelets cause the atria to beat in a very rapid, uncoordinated fashion. Instead of contracting all at once with each heartbeat, the walls of the atria quiver, or **fibrillate**.

The AV node, acting as an electrical gatekeeper (see page 5), allows only some of these wavelets to travel down the conduction pathway and stimulate the ventricles. As a result, the heart rhythm is irregular, erratic, and usually (but not always) rapid.




### *Atrial fibrillation*

*Multiple wavelets of electrical activity flow across the atria. The AV node, acting as the electrical “gatekeeper,” allows only some of these wavelets to travel down the conduction pathway and stimulate the ventricles. On the ECG, the heart rhythm is irregular, erratic, and usually rapid.*



The most common symptom of atrial fibrillation is palpitations. Other symptoms may include fatigue, dizziness, fainting spells, shortness of breath, and chest pain or discomfort. Many people with atrial fibrillation, however, do not have any symptoms.



People with atrial fibrillation are at *increased risk for stroke*. That's because the rapid, uncoordinated contractions of the atria can sometimes cause blood clots to form. The clots may leave the heart and lodge in the brain, causing a stroke.

Antiarrhythmic drugs (see page 26) may be prescribed to restore a normal heart rhythm. Once the normal rhythm is restored, similar drugs are often prescribed to prevent atrial fibrillation from recurring.

If drugs do not work, doctors may perform electrical cardioversion (see page 31) to restore a normal heart rhythm.

In some people, it may not be possible to maintain a normal heart rhythm. Then doctors may decide to allow fibrillation to continue. They prescribe drugs to control the heart rate (while allowing the rhythm to remain irregular). Most people can tolerate an irregular heart rhythm as long as it is not too rapid.

To prevent a possible stroke, doctors may prescribe anticoagulants, drugs that keep the blood from clotting. Anticoagulants help prevent the formation of clots in the atria.

If medications and electrical cardioversion do not work, doctors may consider other treatment options. For example, they may perform catheter ablation (see page 28) to destroy abnormal electrical pathways and/or sites that are causing atrial fibrillation.

### ■ *Atrial Flutter*

Atrial flutter is a rapid heart rhythm caused by the a re-entry circuit (see page 11) in the right atrium. As in atrial fibrillation, the atria beat very fast. Unlike fibrillation, however, the heart's rhythm tends to be mostly regular.

Antiarrhythmic drugs (see page 26) can be used to restore a normal heart rhythm, control the heart rate, and/or prevent recurrences.

If drugs do not work, doctors may try to stop atrial flutter by pacing (delivering electrical impulses to) the atria; or, they may perform electrical cardioversion (see page 31). If atrial flutter recurs frequently or causes annoying symptoms, catheter ablation may be used to destroy the extra pathway (see page 28).

### Ventricular Arrhythmias

Ventricular arrhythmias are abnormal heart rhythms that start in the heart's lower chambers.

### ■ *Premature Ventricular Contractions*

Premature ventricular contractions (**PVCs**) are beats that occur earlier than expected and briefly interrupt the heart rhythm. They start from an abnormal site in one of the ventricles.

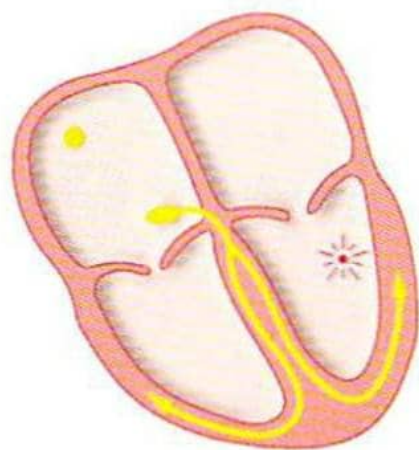
PVCs are very common. Even though they tend to be more common in people who have heart disease, almost everyone has them at least once in a while. Factors that can make PVCs worse include caffeine, alcohol, tobacco, and stress.

PVCs often cause a sensation of “skipped beats” followed by a “thump.” What is really felt is the brief pause that *follows* the PVC. During the pause, the heart has more time to fill with blood, and the next normal beat is usually more forceful.

PVCs do not necessarily require treatment. If they cause annoying symptoms, simple lifestyle changes (such as reducing stress or avoiding caffeine) are often all that’s needed.

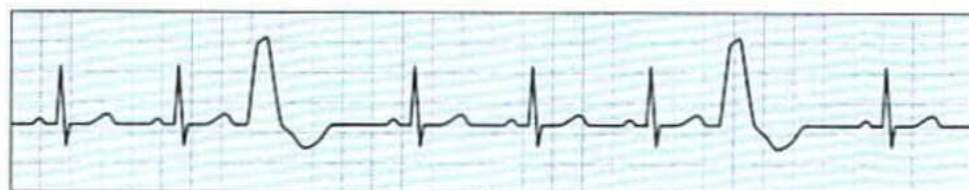
If the symptoms are bothersome, or if the PVCs are frequent or occur in certain patterns, doctors may prescribe medications to help regulate the heartbeat.

Even though antiarrhythmic drugs can be effective in treating PVCs, they can also *sometimes* cause serious arrhythmias. Therefore, doctors use these drugs very carefully and only after a thorough evaluation.



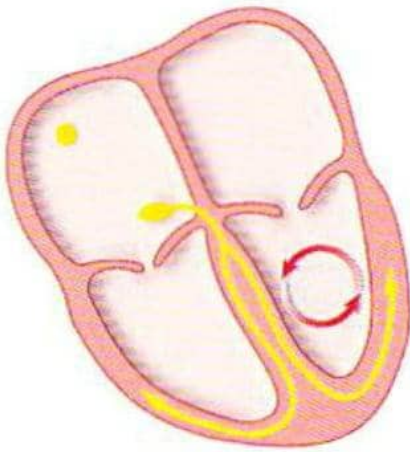
### *Premature ventricular contractions*

*PVCs originate from an abnormal site in the ventricles. The ECG often shows wide and unusual QRS complexes (see page 6) that occur earlier than expected and briefly interrupt the heart rhythm.*



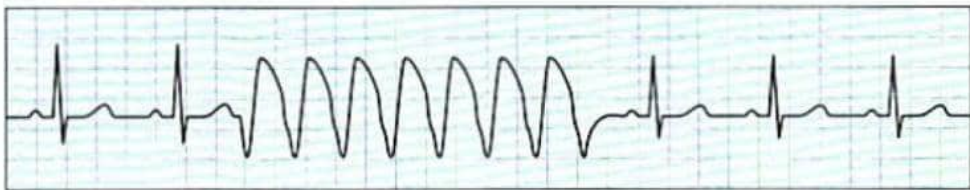
## ■ *Ventricular Tachycardia*

In ventricular tachycardia (VT), one or more extra electrical pathways (re-entry circuits) exist in the ventricles, usually in an area of the heart muscle that was damaged by heart attack or disease. This can cause a rapid heart rhythm that sometimes becomes life-threatening.




### *Ventricular tachycardia*

*An electrical impulse has entered the extra pathway in the ventricle. This impulse travels in a circular pattern and causes the heart to contract with each cycle. The ECG shows wide complexes that follow one another and appear as a wavy line.*



During VT, there is not enough time for the heart to fill with blood between beats. As a result, the heart does not pump blood as efficiently as it does during a normal rhythm.

When an episode of VT is brief (that is, less than 30 seconds), it usually causes only mild symptoms, such as palpitations. When it is **sustained** (lasts more than 30 seconds), VT may cause dizziness, shortness of breath, chest pain, or a fainting spell.



Sustained VT is dangerous, even life-threatening, since it tends to progress to ventricular fibrillation and cardiac arrest (see below).

Sustained VT is usually a *medical emergency*. It can be treated with antiarrhythmic drugs injected into a vein or with electrical cardioversion (see page 31).

Because VT can be life-threatening, it's important to try and prevent it. Doctors often recommend an EP study (see page 9) to help them diagnose the problem accurately and choose the best treatment.

Antiarrhythmic drugs are used less often now than in the past for treating sustained VT. This is because some of these drugs can sometimes cause dangerous arrhythmias.

Implantable cardioverter defibrillators (see page 30) are now often recommended for patients who have had life-threatening VT.

### ■ *Ventricular Fibrillation*

Ventricular fibrillation occurs when multiple sites in the ventricles fire electrical impulses very rapidly and erratically. As a result, the ventricles quiver and cease to pump blood. This quickly leads to **cardiac arrest**. Emergency treatment must be given to get the heart pumping again, or death will result.

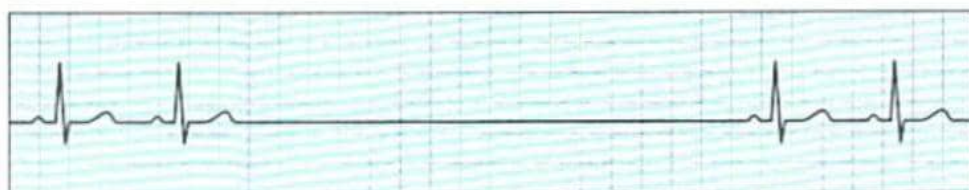
## Slow Heart Rhythms

An arrhythmia can also result in a heart rhythm that's too slow, called a bradycardia. Here's a description of the two most common types of bradycardia.

### ■ *Sick Sinus Syndrome*

With this condition, the SA node fails to perform its role as the heart's natural pacemaker. It may not send electrical impulses often enough, it may skip some, or it may send too many impulses all at once.

In patients with sick sinus syndrome, the heart may beat too slowly (**sinus bradycardia**) or pause too long between beats (**sinus pause**). In some cases, the heart may alternate between being too slow and too fast (**bradycardia-tachycardia syndrome**).



*An ECG recording of a sinus pause.*

Sick sinus syndrome is commonly associated with aging. It may also be caused by heart disease or antiarrhythmic drugs. Symptoms include dizziness, fainting spells, fatigue, and palpitations.

Because sick sinus syndrome may cause both slow and rapid rhythms, its treatment varies. Doctors may prescribe antiarrhythmic drugs (see page 26) to prevent the rapid rhythms *and* implant a pacemaker (see page 29) to prevent the slow rhythms.



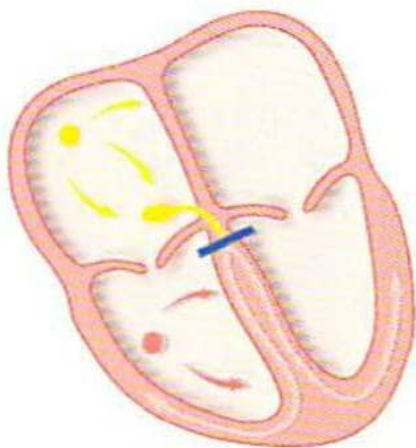
## ■ *Heart Block*

With heart block, electrical impulses are either delayed or stopped as they travel along the pathway from the atria to the ventricles.

In **second-degree heart block**, only some impulses from the atria reach the ventricles. As a result, the heart may beat too slowly or it may skip beats. Some forms of second-degree heart block may progress to complete heart block.

In **complete** (or third-degree) **heart block**, impulses coming from the atria are totally blocked. The result is often a very slow and unreliable heartbeat. This may cause light-headedness, fainting spells, confusion, and fatigue.

If the very slow heart rhythm persists, a pacemaker (see page 29) may be necessary.



### *Complete heart block*

*Impulses coming from the atria are totally blocked. The ventricles are stimulated by a “backup pacemaker” (a site in the heart that takes the place of the SA node). The rhythm is usually very slow.*



## Treatment Options

The treatment your doctor recommends will depend on the type of arrhythmia you have, how severe your symptoms are, and whether you have other problems with your heart.

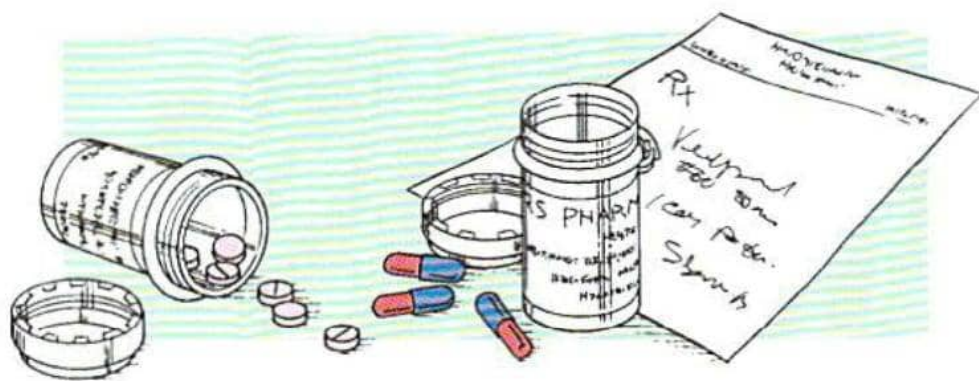
Keep in mind, however, that not all arrhythmias require treatment. Quite often, making a few changes in lifestyle (such as reducing stress or avoiding caffeine, tobacco, or alcohol) is all you need to do to regulate your heartbeat.

In the following pages, we'll describe a few common treatments for arrhythmias. Your doctor will decide if your arrhythmia needs treatment, and if so, which option is best for you.

### ■ *Antiarrhythmic Drugs*

Antiarrhythmic drugs are used for restoring a normal heart rhythm and/or preventing the recurrence of arrhythmias.

Most antiarrhythmic drugs work by changing the electrical signals within the heart. By doing so, they help prevent abnormal sites in the heart from starting irregular or rapid heart rhythms.



## TAKING ANTIARRHYTHMIC DRUGS

- Know when and how often each medication should be taken. Try to take your medications at the same time or times each day.
- If you miss a dose or two, don't take all the pills you have missed at one time. Just get back on your normal schedule.
- If you think you are having a side effect, call your doctor. Never just stop treatment!
- Even if you start to feel better, don't stop taking your medications or change the dosage unless your doctor tells you to.

Some drugs (such as beta blockers, calcium channel blockers, and digoxin) reduce the number of atrial impulses that are transmitted through the AV node (see page 5). In patients with atrial fibrillation or SVT, for example, these drugs are useful in slowing down the heart rate.

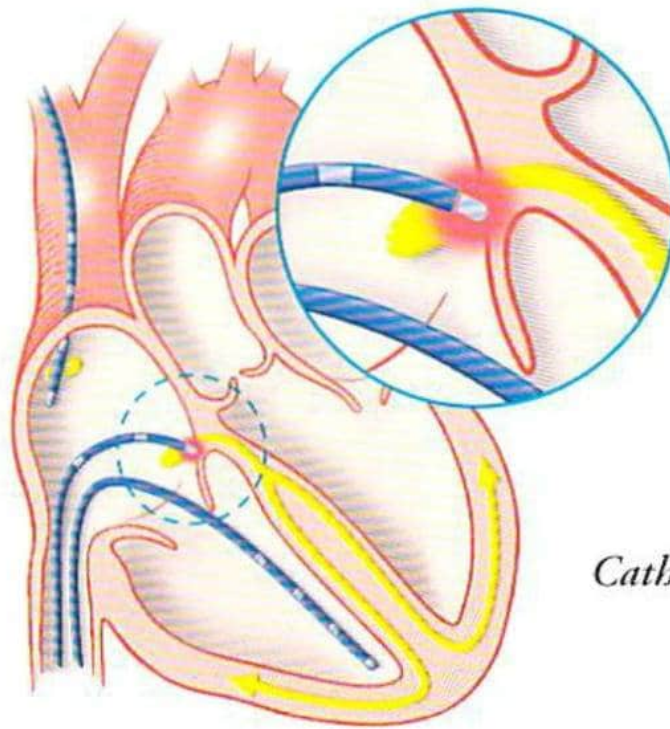
Antiarrhythmic drugs are generally effective, but they may cause side effects. Common side effects include nausea, fatigue, dizziness, or headache. A serious side effect of some drugs is that they can *sometimes* cause dangerous arrhythmias.

### ■ *Catheter Ablation*

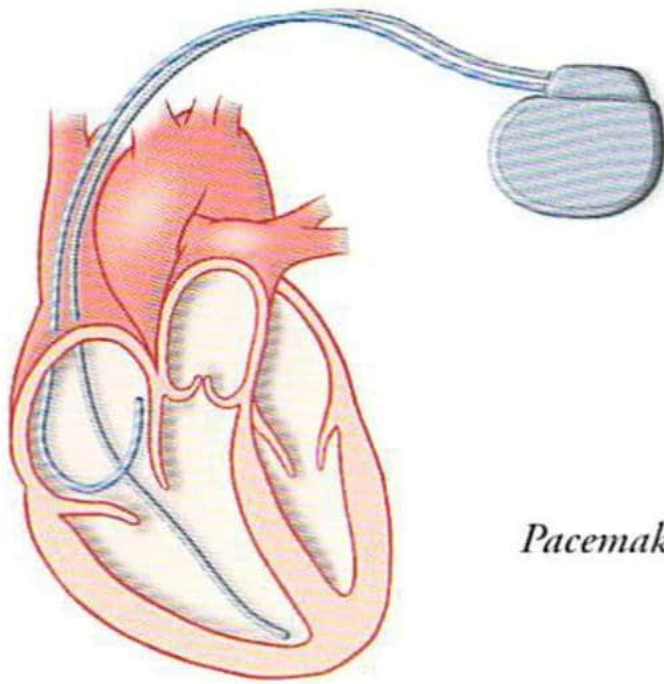
Catheter ablation is a technique doctors use to ablate (destroy) parts of an abnormal electrical pathway that is causing a *rapid* heart rhythm problem.

During ablation, doctors insert a special electrode catheter into the heart. They position the catheter so that it lies close to the abnormal pathway. Then they pass radio-frequency (heat) energy through it. The tip of the catheter heats up and destroys the small area of heart tissue that contains the abnormal pathway.

Catheter ablation is a low-risk procedure that can permanently cure a heart rhythm problem. It works best when the rapid rhythm starts in the atria. It is less effective in patients with ventricular tachycardia.



*Catheter Ablation*



*Pacemaker*

### ■ *Pacemaker*

A pacemaker is a small, lightweight, electronic device that is implanted in the body to pace the heart (make it beat). It is prescribed for people whose hearts are beating *too slowly*.

The pacemaker has two parts: a pulse generator that contains a battery and electronic circuitry, and one or two pacing wires, or leads, that carry electrical impulses from the pulse generator to the heart.

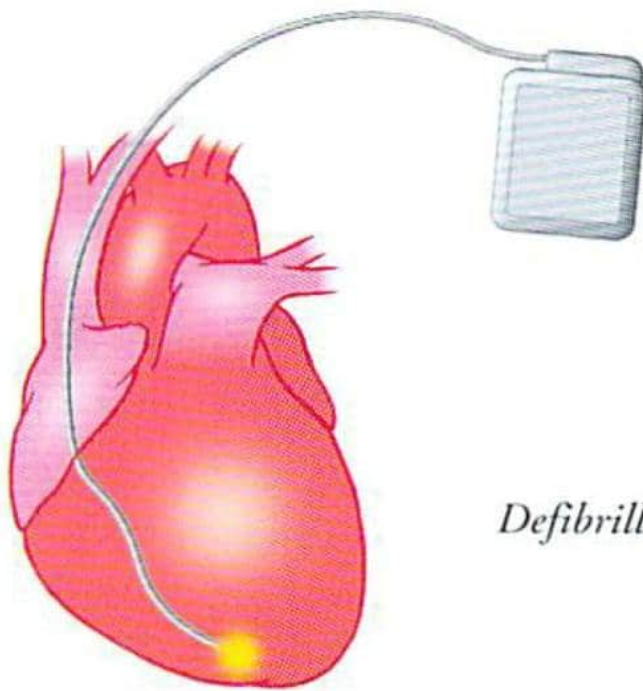
The pacemaker keeps track of the heart's electrical activity. If it senses that the heart is beating too slowly or is pausing too long between beats, the pacemaker delivers electrical impulses that stimulate the heart and keep it beating at the proper rate.


### ■ *Implantable Cardioverter Defibrillator*

An implantable cardioverter defibrillator (**ICD**), like a pacemaker, is a small electronic device that is implanted in the body. It is prescribed for people whose hearts are beating *too rapidly*.

The ICD continuously monitors the heartbeat. If it senses a dangerous rapid heart rhythm, the device delivers one or more impulses or shocks to the heart and restores a normal rhythm.

ICDs are used for people who have survived a cardiac arrest or who have had a heart rhythm problem that could lead to cardiac arrest (such as ventricular tachycardia and fibrillation).





## ■ *Electrical Cardioversion*

Electrical cardioversion is a procedure that is done to stop an arrhythmia. It is used for treating certain *rapid* heart rhythms.

During cardioversion, an electric shock is delivered to the heart through the chest wall. The shock causes the heart cells to fire impulses all at once. This momentarily stops all electrical activity in the heart, and allows the normal heart rhythm to take over.

While electrical cardioversion is very effective, it does not prevent arrhythmias (such as atrial fibrillation) from recurring. For this reason, antiarrhythmic drugs are often prescribed to prevent recurrences.

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Your doctor can explain the risks and benefits of the various treatments and advise you on the treatment option that's best for you.

Follow your doctor's instructions, take medications as directed, and report any symptoms and side effects. That's the best way to make sure you get the most benefit from whatever treatment option your doctor recommends.

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