

Put your heart in the right place

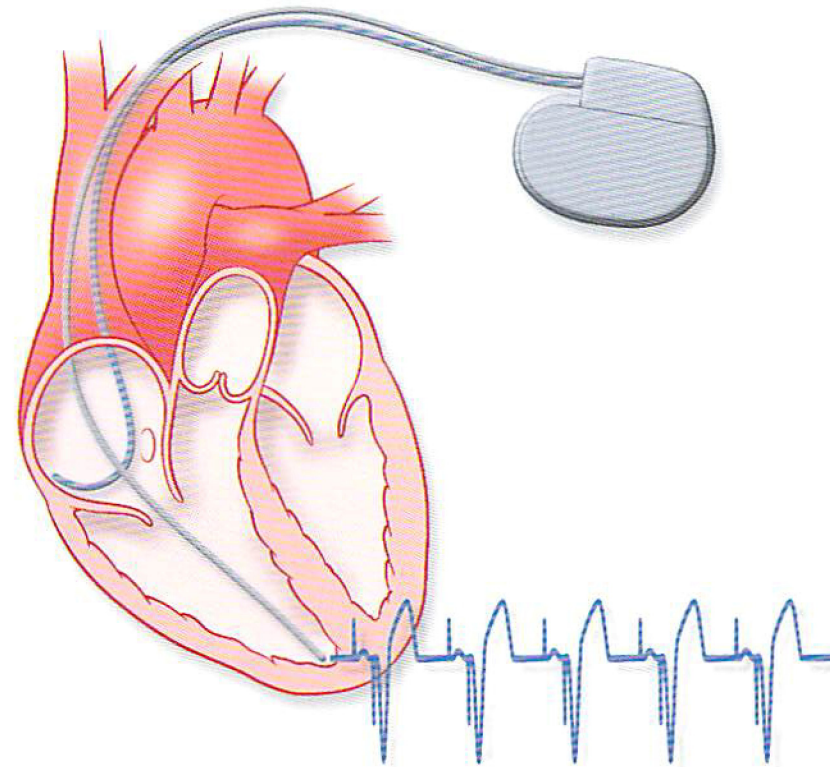
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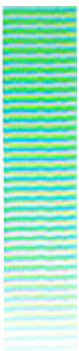
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# Pacemakers



***A Patient's Guide***



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

## Your Pacemaker and You

Here are a few simple rules that will help you live safely with your pacemaker:

- Keep your appointments with your doctor or pacemaker clinic.
- Always tell any medical personnel that you have a pacemaker.
- Carry your pacemaker identification card with you at all times.
- Do not fiddle or play with your pacemaker. This could damage or dislodge the lead(s).
- If you have questions whether a situation or piece of equipment might interfere with your pacemaker, ask your doctor or nurse.
- If a piece of equipment causes you to have dizziness or palpitations, simply move away from it. The pacemaker will return to working normally right away.
- Tell your doctor or nurse if your address has changed or if you plan to take a trip.



### ■ *Security systems*

It is OK to walk through security gates, such as those at airports and stores. The system will not harm your pacemaker. But it may detect the metal case around the pacemaker and set off the alarm. If this happens, show your wallet card to security personnel.

However, hand-held security wands, such as those used at airports, may interfere with your pacemaker (because they contain a magnet). Show your wallet card to security and ask to be hand searched in place of the hand-held wand.

At the entrance to stores and libraries, you may walk normally through anti-theft security gates. However, do not stay near the theft detection equipment.

### ■ *Cellular phones*

A cellular phone can affect your pacemaker if the phone is held too close to it. This effect is temporary. Simply move the phone away from the pacemaker and the pacemaker will work normally again.

When using a cellular phone, hold the phone to the ear farthest from your pacemaker. Do not carry the phone in a breast pocket or on a belt within 6 inches of where the pacemaker is implanted.

(These precautions apply only to *cellular* phones, not to indoor cordless phones.)

Your doctor may have told you that you need a pacemaker. Now, you probably have questions and concerns about the pacemaker, how it is inserted into your body, and how to care for it. This booklet can help answer many of your questions.

### **What Is a Pacemaker?**

A pacemaker is a small, lightweight electronic device that is prescribed for people whose hearts are beating too slowly. It is **implanted** (inserted) into the body, usually in the upper chest, near the shoulder.

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 pace (stimulate) the heart and keep it beating at the proper speed.

### **Why Is the Pacemaker Important?**

If your **heart rhythm** (the speed and pattern of your heartbeat) is too slow, this may cause symptoms such as lightheadedness, fainting spells, and tiredness.

A pacemaker gives your heart the extra help it needs to relieve your symptoms and help you feel better. Also, having a pacemaker can give you more freedom to do the activities you enjoy.

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## How the Heart Works

Before you learn about the details of pacemakers, it helps to understand how the heart works.

### The Heart as a Pump

The heart is a hollow organ made of a strong muscle that constantly pumps blood throughout the body.

The heart has four chambers: 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 out of the heart.

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 has an electrical system that produces tiny electrical impulses. These impulses travel from the upper to the lower chambers and tell the chambers to contract and pump blood.

The heart's electrical impulses normally begin at the sinoatrial node, or **SA node**. This cluster of special cells, also known as the heart's natural pacemaker, is located at the top of the right atrium. It produces electrical impulses at regular intervals and sets the proper rhythm for the heartbeat.

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

### ■ *Things to avoid*

To make sure your pacemaker works properly, you should avoid the following:

- Large generators, electric motors, arc welders, and other large industrial equipment
- Radio transmitters, high-voltage power lines
- Magnetic therapy products, such as mattress pads, pillows, and massagers
- Maintaining or repairing any electrical or gasoline-powered appliances
- Leaning over the open hood of a running car

***Important:** If you have questions about the safety of a particular appliance, tool, or activity, check with your doctor or nurse or call the company that makes the pacemaker.*

### ■ *Medical procedures*

Most medical procedures are not likely to interfere with your pacemaker. Some procedures, however, produce strong magnetic fields and should usually be avoided (talk to your doctor first). These include: magnetic resonance imaging (MRI), electrocautery, diathermy, lithotripsy, transcutaneous electrical nerve stimulation (TENS), and radiation therapy.

***Important:** Always tell any doctors or other medical personnel that you have a pacemaker.*



## Avoiding Interference

Things that use magnets or electricity have magnetic fields around them. These fields are usually weak and will not affect your pacemaker. However, strong magnetic fields can interfere with your pacemaker and may temporarily affect the way it works.

### ■ *Items that are safe*

You can safely operate most household and office appliances that are properly grounded and in good working order. These include:

- Kitchen appliances such as microwave ovens, toasters, blenders, and electric can openers
- Radios, televisions, CD/DVD players, pagers, remote controls, garage door openers
- Hand-held appliances such as hair dryers and shavers (avoid holding against the implant site)
- Major appliances such as refrigerators, washers, dryers, and electric stoves
- Electric blankets and heating pads
- Personal computers, printers, fax machines, and copy machines

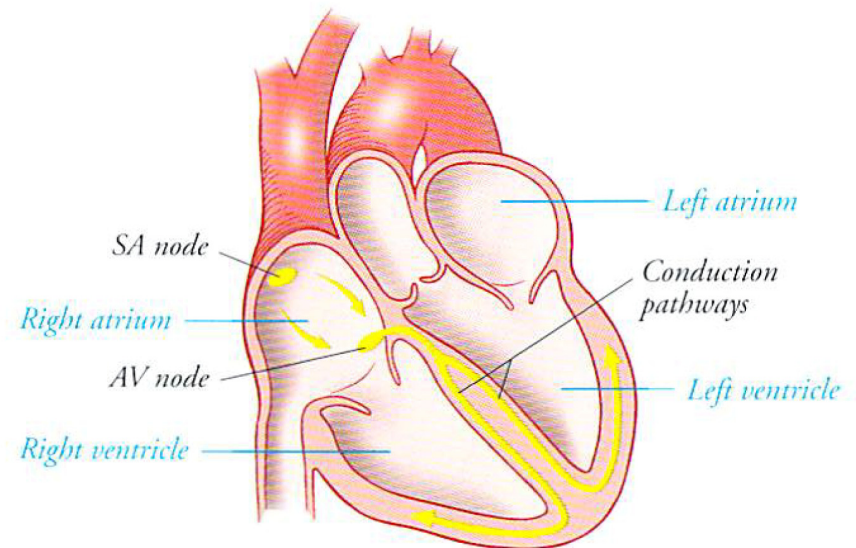
### ■ *Items that can be used but should remain at least 12 inches away from the implant site*

- Battery-powered, cordless power tools such as screwdrivers and drills
- Shop tools, such as corded drills and table saws
- Lawn mowers, leaf blowers
- Slot machines, stereo speakers

From the atria, the electrical impulse reaches the atrioventricular node, or **AV node**, which is located between the atria and the ventricles. The AV node slows down each electrical impulse before it passes through to the ventricles.

The impulse then travels to the ventricles through **conduction pathways**. The impulse stimulates the ventricles, causing them to contract and pump blood out of the heart.

At rest, the SA node normally starts 60 to 100 beats a minute. When you are physically active or excited, your body needs more blood flow. A healthy SA node responds to these changes in the body by increasing the **heart rate** (the number of beats per minute).



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## When Is a Pacemaker Needed?

Sometimes, the heart's electrical system does not work properly. This may cause abnormal heart rhythms, called **arrhythmias**. During an arrhythmia, the heart may beat too slowly, too fast, or irregularly.

A pacemaker is most commonly used to treat heart rhythms that are too slow (bradycardias). In some cases, it may be used to treat other conditions, such as syncope (see page 8).

### Understanding Bradycardias

**Bradycardia** is the medical term for a heart rhythm that is too slow. During bradycardia, the heart pumps less blood. As a result, the body may not get enough oxygen and nutrients.

The most common symptoms of severe bradycardia are lightheadedness, fainting spells, and tiredness. Other symptoms include confusion (especially in the elderly), palpitations, and shortness of breath.

Bradycardias are often caused by “wear-and-tear” of the heart. They are therefore more common in the elderly. They may also be caused by heart disease or by some medications.

Sick sinus syndrome and heart block are the two most common types of bradycardia that may require a pacemaker.

Types of exercise that are good for the heart include brisk walking, jogging, swimming, bicycling, tennis, aerobic workouts, and dancing.

Avoid activities where you could get hit or fall on the area near your pacemaker. Activities to avoid include football, basketball, baseball, racquetball, soccer, and skiing. Also, avoid hunting if a rifle butt is rested on or next to the implant site on your chest.

### ■ *Travel*

Once you have recovered from surgery, you will be free to travel with the pacemaker.

If you plan to be away for more than 3 months, you should arrange with your doctor to see a specialist or clinic in the area you will be visiting. Get a copy of your medical records to take with you.

### ■ *Your Emotions*

It is natural for patients and their families to feel anxious about the pacemaker at first. Other feelings, such as fear, depression, and anger are normal, too.

The good news is that these feelings rarely last for more than a few weeks. Most patients gradually adjust to having a pacemaker and are able to resume their normal daily routine. If such feelings last for more than a couple of months, talk to your doctor.

## Living with a Pacemaker

Your pacemaker will help you feel better by relieving symptoms caused by a slow heart rhythm. Having a pacemaker may also give you more freedom to do the things you enjoy.

However, there are a few things you need to be aware of, so that your pacemaker works properly.

### Resuming Daily Activities

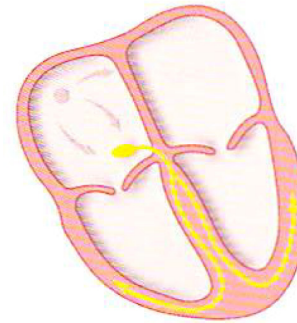
Ask your doctor or nurse how soon you can go back to your normal daily activities and hobbies. These may include walking, playing golf, gardening, driving, and returning to work.

#### ■ Exercise

Several weeks after your surgery, you may be ready to do more strenuous exercise. Be sure to talk with your doctor before you start an exercise program.



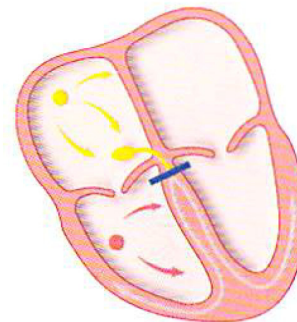
- In **sick sinus syndrome**, the SA node (see page 4) does not work properly. It may not send electrical impulses often enough, it may skip some, or it may send too many impulses all at once. As a result, the heart may beat too slowly or pause too long between beats. Sometimes, the heart may alternate between beating too slowly and too fast.



#### *Sick sinus syndrome*

*The SA node does not work properly. It may not send electrical impulses often enough, or it may skip some signals. As a result, the heart rhythm may be very slow, or there may be long pauses between beats.*

- In **heart block**, electrical impulses that travel from the atria to the ventricles (along the conduction pathways) are either delayed or stopped. As a result, the heart may skip some beats, or it may beat too slowly. In **complete** heart block, the impulses coming from the atria are totally blocked. This often results in a dangerously slow heart rhythm.



#### *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 heart rhythm is usually very slow.*



## Understanding Syncope

**Syncope** is the medical term for a fainting spell. It is a sudden and brief loss of consciousness. Syncope occurs when the brain does not get enough blood and oxygen.

- In **neurocardiogenic syncope**, the most common type of syncope, the nerves that control the heart and blood vessels do not work properly. This may cause the heart to slow down and blood pressure to drop, which in turn may cause fainting.
- In **carotid sinus syncope**, the carotid sinus (an area inside the carotid artery, in the neck) is “too sensitive.” Turning the head, wearing clothes that are tight around the neck, or shaving can put pressure on the carotid sinus. This may cause the heart to slow down and/or blood pressure to drop, which in turn may cause a fainting spell.



## When To Call Your Doctor

If you have a pacemaker, you will be told when to call your doctor or nurse. Call as instructed or when any of these things occur:

- You experience any of the symptoms you had before the pacemaker was implanted.
- You have symptoms such as lightheadedness, fainting spells, palpitations, shortness of breath, chest pain, or lack of energy.
- You have twitching chest muscles or hiccups that will not stop.
- You are going to have a medical procedure, especially if it involves surgery.
- You have questions about your pacemaker, medications, or activities.





## Replacing the Battery

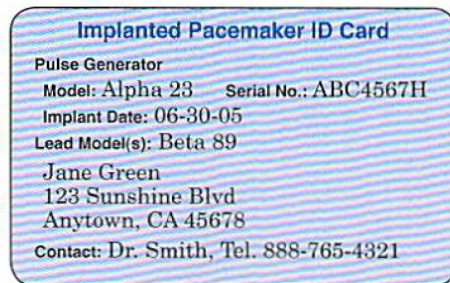
Pacemakers are powered by long-lasting lithium batteries. How long the battery lasts depends on your medical condition, the type of pacemaker you have, and the way it is programmed. In general, a battery lasts 5 to 8 years.

Since the battery is sealed inside the pulse generator, the entire pulse generator must be replaced when the battery wears out. In most cases, the original leads will not need to be replaced.

## Pacemaker Identification Card

You will be given a wallet card that gives information about your pacemaker. It also includes your doctor's name and phone number. Carry your pacemaker identification card with you at all times! Show it to any health care provider you visit.

Also, because your pacemaker may set off security devices like those found in airports, libraries, and department stores, you may need to show your card to security personnel (see page 30).



## When Can a Pacemaker Help?

The decision on whether you need a pacemaker will depend on the type of arrhythmia you have, how severe your symptoms are, and whether you have other problems with your heart.

Your doctor may recommend a pacemaker if you have one or more of the following conditions:

- ▶ bradycardia with significant symptoms, such as dizziness, fainting spells, tiredness, confusion, or shortness of breath
- ▶ bradycardia with a very slow heart rate or long pauses between beats, even without symptoms
- ▶ arrhythmias where the heart alternates between beating too fast and too slowly
- ▶ arrhythmias and other medical conditions that require medications that cause bradycardia
- ▶ recurring syncope that is caused, at least in part, by significant slowing of the heartbeat
- ▶ severe bradycardia caused by heart surgery or catheter ablation

Your doctor will decide if you need a pacemaker, and if so, he or she will explain the reasons to you.

## Understanding Pacemakers

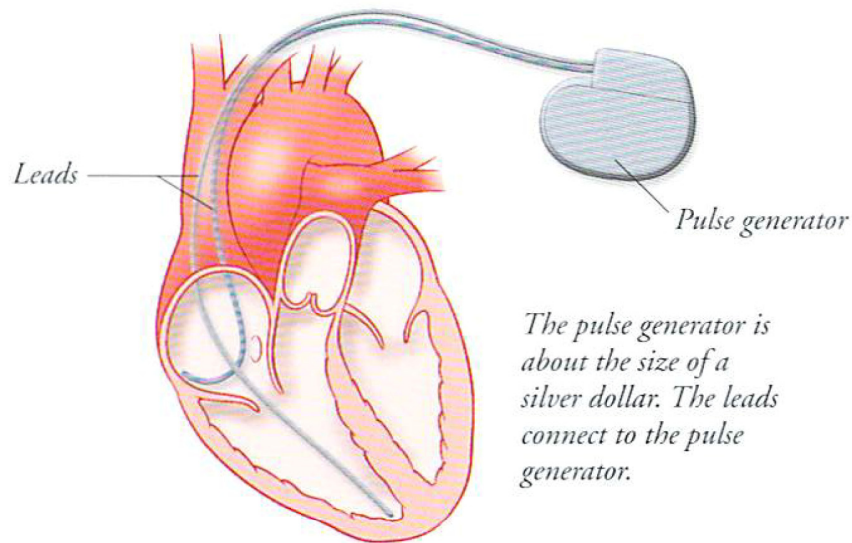
A pacemaker is a small electronic device prescribed for people whose hearts are beating too slowly. The pacemaker stimulates the heart muscle with precisely timed electrical impulses that keep the heart beating at the proper rate.

### The Parts of a Pacemaker

A pacemaker has two main parts: a pulse generator and either one or two leads.

#### ■ *Pulse Generator*

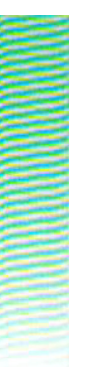
The pulse generator is a small, lightweight metal case with a battery and circuitry. The battery supplies the electrical energy. The circuitry is like a tiny computer inside the pacemaker. It produces electrical impulses and controls how often and when these impulses are delivered to the heart.



### Common Pacemaker Terms

The following words and terms are commonly used to describe pacemakers and how they work.

- ▶ **Pulse generator** The part of the pacemaker that contains the battery and circuitry.
- ▶ **Circuitry** The tiny computer inside the pacemaker that controls how often and when electrical impulses are delivered to the heart.
- ▶ **Lead** An insulated, flexible wire that carries electrical impulses from the pacemaker to the heart. It also sends information about the heart's natural electrical activity back to the pacemaker.
- ▶ **Pacing** The pacemaker function that sends electrical impulses to the heart to cause it to beat.
- ▶ **Sensing** The pacemaker function that keeps track of the heart's natural electrical activity.
- ▶ **Single-chamber pacemaker** A type of pacemaker that has one lead, placed in either the right atrium or the right ventricle.
- ▶ **Dual-chamber pacemaker** A type of pacemaker that has two leads. One is placed in the right atrium, and the other is placed in the right ventricle.
- ▶ **Programmer** A device that allows the pacemaker's settings to be adjusted from outside the body.
- ▶ **Reprogramming** The adjustment of a pacemaker's settings, done from outside the body.
- ▶ **Rate-adaptive pacemaker** A type of pacemaker that can increase or decrease its rate in response to the body's needs, activity, or exercise.
- ▶ **Sensor** A part of a rate-adaptive pacemaker that recognizes body changes, such as changes in motion or breathing.



## Telephone Monitoring

Telephone monitoring allows you to send your ECG by telephone. This can be helpful if you live at a distance from the clinic or if traveling to the clinic is difficult.

If your doctor recommends telephone monitoring, you can subscribe to a service. You will be given a special **transmitter** that allows you to record and transmit your ECG over the telephone line. You will also receive a transmission schedule that tells you how often you need to use the service.

When you transmit your ECG, a receiving device in the monitoring office records the signals and prints a tracing. The tracing is analyzed by a technician and the information is sent to your doctor.



## ■ *Lead (or Leads)*

A lead is an insulated and flexible wire. It is threaded through a vein and placed in the heart. The lead carries electrical impulses from the pacemaker to the heart. It also relays information about the electrical activity of the heart back to the pacemaker.

One or more leads may be used, depending on the type of pacemaker that is implanted (see page 12).

## How Does a Pacemaker Work?

A pacemaker has two main functions. It keeps track of the heart's natural electrical activity (this is called **sensing**). It also sends electrical impulses to the heart to make the heart beat (this is called **pacing**).

For example, if the pacemaker senses that the heart is beating too slowly or pausing for too long, it sends tiny electrical impulses. These impulses are too slight for you to feel, but they stimulate the heart muscle to contract and pump blood.

If the pacemaker senses that the heart is beating at a proper pace, it goes "on demand" and stands by until it is needed. The instant the heart starts beating too slowly or pauses for too long, the pacemaker will begin pacing again.

The pacemaker's sensing and pacing functions are adjusted, or "programmed," by your doctor to meet your particular needs (see page 21).

## Types of Pacemakers

There are several types of pacemakers, each designed to meet a different need.

### ■ *Single-Chamber Pacemaker*

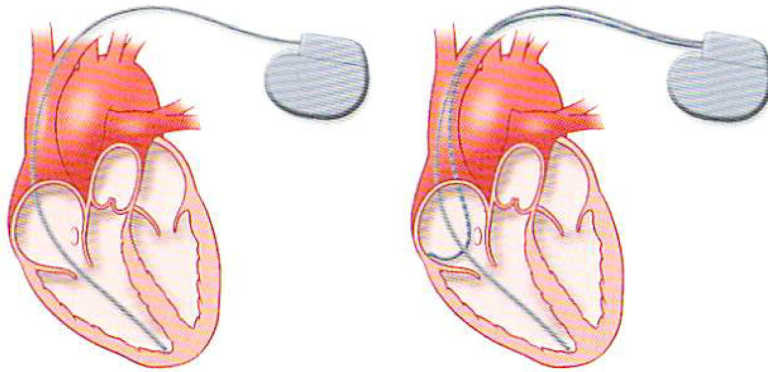
A single-chamber pacemaker has only one lead. The lead is placed in either the right atrium or the right ventricle, depending on the type of rhythm problem.

### ■ *Dual-Chamber Pacemaker*

A dual-chamber pacemaker has two leads. One lead is placed in the right atrium, the other is placed in the right ventricle.

A dual-chamber pacemaker can monitor and deliver impulses to both chambers. The impulses are timed so that the atria (upper chambers) are stimulated to contract just before the ventricles (lower chambers).

This timing ensures that the heart's upper and lower chambers beat "in sync" with one another, which helps the heart beat more efficiently.



*Single-chamber pacemaker*

*Dual-chamber pacemaker*

## Adjusting Your Pacemaker

From time to time, you may have a more thorough checkup of the pacemaker. The doctor or nurse will use a **programmer**, a device that can "talk" to your pacemaker, to make sure it is working properly.

If your medical condition changes, the programmer can be used to "reprogram" your pacemaker. During reprogramming, the settings are adjusted to better treat your slow heart rhythm. This is done from outside your body, so it is painless. In a way, it works like a remote control for programming a VCR.



If you have a rate-adaptive pacemaker (see page 13), you may be asked to do some physical activity, such as walking, during the visit. This allows the doctor to check the pacemaker's settings and see how well it increases your heart rate during activity.

## Caring for Your Pacemaker

It is important that you have follow-up visits with your doctor or pacemaker clinic. Your pacemaker may also be checked through telephone monitoring (see page 22). In some cases, your pacemaker may need to be replaced (see page 24).

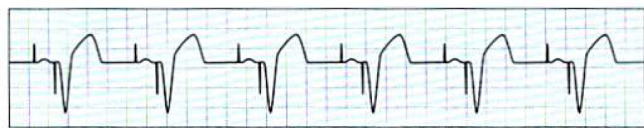
### Follow-up Visits

Follow-up visits are needed to help ensure that your pacemaker is working properly. A typical visit takes about 30 minutes.

How often you have follow-up visits depends on the type of pacemaker you have and on your medical condition. Most patients have their pacemaker checked several times during the first year, and then once or twice a year after that.

Follow-up visits allow your doctor or nurse to see how well your pacemaker is interacting with your heart, and to check the pacemaker's settings and the level of the battery.

During your follow-up visit, you will also have an electrocardiogram (ECG). The ECG records the electrical activity of both your heart and pacemaker.



*An ECG recording of a pacemaker rhythm*

### ■ *Rate-Adaptive Pacemaker*

A rate-adaptive pacemaker uses special **sensors** that detect changes in the body, such as movement of the arms and legs, or how fast a person is breathing. The device adjusts its pacing rate up or down in response to the body's needs and activity (see figure). This type of pacing mimics the heart's natural function and may allow a more active lifestyle.

Rate-adaptive pacemakers can be single-chamber or dual-chamber devices. Many pacemakers used today are rate-adaptive.



*A rate-adaptive pacemaker adjusts its pacing rate (the number of pacing impulses per minute) up or down in response to the body's needs and activity.*

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## Implanting Your Pacemaker

Implanting a pacemaker does not require open heart surgery. Rather, it is a minor surgical procedure done under local anesthesia. It is usually done in an operating room or a cardiac catheterization lab.

### Preparing for Implantation

Unless you are already in the hospital, you will most likely be asked to arrive in the morning on the day of the procedure, or perhaps the night before.

You may have several routine tests, such as an ECG, x-rays, and blood tests. (These tests may be done a few days before the procedure.)

The doctor will review your medical history and examine you. (You may see the doctor at the office several days before the procedure.)

The doctor or nurse will talk with you about the procedure and its purpose, benefits, and risks. This is a good time to ask questions and, most important, to share any concerns you may have. You will then be asked to sign a consent form.

An intravenous (IV) line will be inserted into a vein in your arm. This line allows drugs to be injected directly into the vein, if they are needed. To help you relax, you will be given a sedative.

### The First Few Weeks

- Follow your doctor's instructions regarding activity, exercise, and returning to work.
- Keep the incision site completely dry for a week or so, to help prevent infection.
- Do not lift anything heavier than 10 to 15 pounds. Also, avoid too much pushing, pulling, or twisting.
- For about 2 weeks, do not raise the arm on the pacemaker side above shoulder level.
- Call your doctor if the incision site shows signs of infection (pain, redness, swelling), there is drainage from the incision, or you develop a temperature over 100°F.
- Call your doctor if you have twitching chest muscles, hiccups that will not stop, or a swollen arm on the side of the incision.
- Call your doctor if the symptoms you had before come back, or if you have dizziness, chest pain, or shortness of breath.
- Be sure to check with your doctor or nurse about medications—which ones to keep taking and which ones to stop.
- Tell any doctors and medical personnel you see that you have a pacemaker.



## After the Procedure

After the pacemaker is implanted, you will be taken to the recovery area or to your room. A nurse will take your pulse and blood pressure and will also check the incision for bleeding or swelling.

During your hospital stay, your heart rhythm will be monitored at all times. Your doctor may also test the pacemaker to make sure it is working properly. This is done from outside the body.

It is normal to have some pain and stiffness around the incision site for a few days. Your doctor will most likely prescribe pain medication to help make you more comfortable. Do not raise the arm on the side of the incision above shoulder level.

Most patients stay in the hospital overnight; some will stay an extra day. Before you go home, you will be given instructions about caring for the incision, physical activity, and medications. When it is time to leave, have a friend or family member drive you.

## Recovering at Home

A few days after you leave the hospital, you will most likely be able to go back to your usual daily activities. However, it may take a few weeks before the incision is completely healed.

For a few weeks, you may feel numbness or fullness in the area around the pacemaker. This is normal. You may also be aware of the pulse generator under the skin, but gradually you will adjust to it.

## Before the Procedure

- Generally, you'll be asked not to eat or drink anything for 6 to 8 hours before the procedure. This helps prevent nausea. You may have small sips of water with your medications.
- Check with your doctor a few days before the pacemaker is to be implanted. You may be asked to stop some medications (such as aspirin) for a few days before the procedure.
- Make arrangements with a friend or family member to drive you to and from the hospital. You will not be allowed to drive home after the procedure, since you may be sedated.
- Pack a small bag for your hospital stay. You may want to include a robe, slippers, pajamas or nightgown, and toiletries.
- Bring a list of the names and dosages of all the medications you are taking.
- Tell the doctor or nurse if you have had any allergic reactions to medications or if you have a history of bleeding problems.
- Pacemakers can be placed near the right or left shoulder. If you prefer a particular side, let the doctor know.
- Be sure to empty your bladder before the procedure starts. (A bedpan or a urinal will be available, in case you need it.)



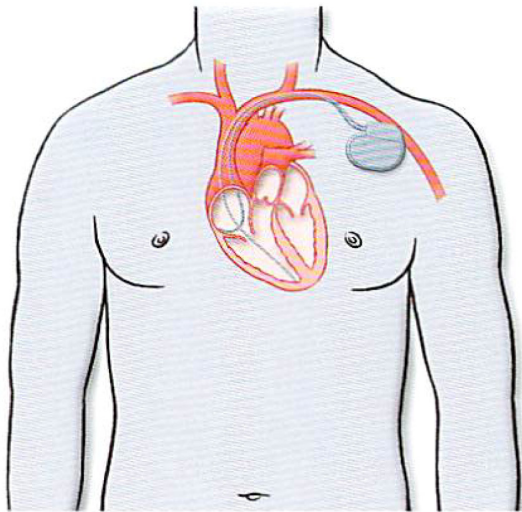
### During the Procedure

Most often, the pacemaker is implanted in the upper chest, near the right or left shoulder. Occasionally, it may be implanted under the skin in the abdomen.

A local anesthetic is injected to numb the area where the pacemaker will be inserted. An incision is made below the collarbone and a “pocket” is created under the skin, where the pulse generator will be placed.

The lead is inserted through the chest incision and into a vein. With the help of an x-ray camera, the lead is passed through the vein and placed inside the heart. If a second lead is needed (dual-chamber pacemaker), this process is repeated.

After a lead is in place, it is tested to make sure it senses the heart signals correctly. Each of the leads is then connected to the pulse generator.



The pulse generator is set to treat your arrhythmia and placed in the “pocket” in the chest. The device is tested to make sure it is working properly. Then the incision is closed and covered with a sterile dressing.

You will be given medication to help you relax and make you drowsy. You may be awake, or you may sleep through part or all of the procedure. The staff will be monitoring you at all times. Be sure to let them know if you feel any pain or discomfort. The procedure usually takes 1 to 2 hours.

### An Alternative Method

Occasionally, doctors attach the lead(s) to the *outside* of the heart and place the pacemaker’s pulse generator underneath the skin in the abdomen. This method requires general anesthesia and is usually done in patients who are having heart surgery. It is also often used for children because their bodies will grow.

### Is Implanting a Pacemaker Safe?

Implanting a pacemaker is a simple procedure with little risk. However, as with any surgery, problems or complications can occur.

Some patients may develop bleeding at the incision or pocket site. Blood collects under the skin, resulting in local swelling and/or a bruise.

In rare cases, the procedure may lead to more serious complications, including damage to the heart and blood vessels, a punctured lung, infection, and blood clots. Death is very rare.