



### Work with Your Doctor

A pacemaker can help you have more energy. It can let you feel more confident about your heart and your health. But it's up to you to do your part. See your doctor for regular checkups. Ask for support in making changes and forming new habits. Also take good care of your heart. Then you can focus on the things in life that mean the most to you.

### For More Information

If you want to learn more about pacemakers and heart rhythm problems, try these resources:

- **American Heart Association**  
www.heart.org 800-242-8721
- **Heart Rhythm Society**  
www.hrspatients.org

Also available in Spanish



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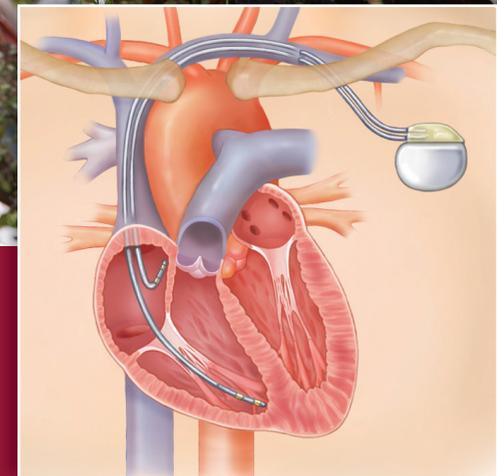


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# UNDERSTANDING PACEMAKERS



## Living Well with a Pacemaker

# Why You Need a Pacemaker

Ask your doctor if you should wear a medical alert bracelet.



Your heart has an electrical system that keeps it beating at the right speed. Problems with this system can make your heart beat too slowly. To correct this, your doctor may recommend a pacemaker. This booklet will tell you what a pacemaker is and how it's placed in the body. You'll also find out how a pacemaker can improve your health and help you lead a more active life.

## When You Have a Slow Heartbeat

Blood carries oxygen throughout the body. When the heart beats too slowly, less oxygen gets to where it's needed. This can cause symptoms such as:

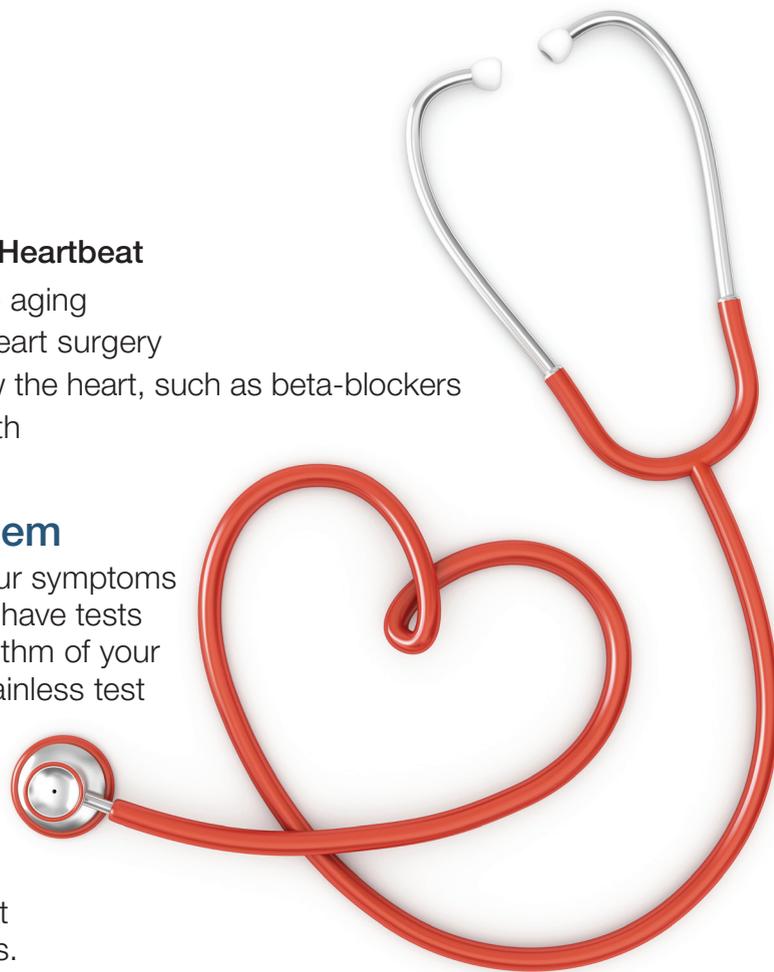
- Dizziness
- Lightheadedness
- Shortness of breath
- Fatigue
- Fainting spells (syncope)

## Common Causes of a Slow Heartbeat

- Changes in the heart due to aging
- Heart disease or previous heart surgery
- Taking medications that slow the heart, such as beta-blockers
- Heart defects present at birth

## Diagnosing the Problem

Your doctor will ask about your symptoms and health history. You'll also have tests that check the speed and rhythm of your heartbeat. These include a painless test called an electrocardiogram (ECG or EKG). You may also be asked to wear a Holter monitor or an event recorder. These small devices record your heartbeat over a period of hours or days.



## Carry an ID Card

You'll receive an ID card that contains important information about your pacemaker. Show the ID card to any healthcare provider you visit. You may also need to show the card to security staff at times. This is because pacemakers tend to set off security devices. Be sure to show your card to security guards at the airport. They have special procedures to keep screening devices from interfering with your pacemaker.

## Exercise Regularly

Having a pacemaker doesn't mean you can't be active. In fact, you may find that exercising is easier with a pacemaker. If you're not sure where to begin, ask your doctor for advice. He or she can help you design an exercise program that fits your needs. Most activities are fine. But talk with your doctor if you play contact sports or do weight lifting. In some cases, these could damage your pacemaker.

## Keep Seeing Your Doctor

To get the best results from your pacemaker, keep seeing your doctor for regular checkups. If you have any symptoms that concern you, be sure to give your doctor a call right away.





**It's safe for you to do almost any activity you like. However, there are a few things that you'll need to keep in mind. If you have any questions about pacemaker safety, be sure to talk with your doctor.**

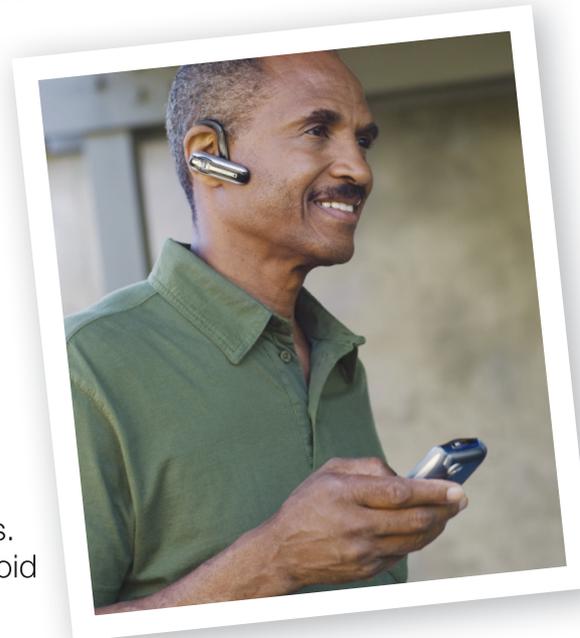
## Your Pacemaker and Outside Signals

Most machines and devices will NOT interfere with your pacemaker. For example, it's safe to use microwave ovens, computers, radios, and televisions. Hair dryers, electric blankets, and most power tools are also okay. However, use caution around certain devices (see below). If you're not sure whether a device is safe, ask your doctor or call the pacemaker manufacturer.

## Signals That Can Cause Problems

Certain signals may interfere with your pacemaker. In general, they won't permanently damage your device or harm your heart. Contact your doctor if any of the following cause symptoms:

- **Cellphones** should not affect your pacemaker. To be safe, keep them 6 inches away from your generator. When talking, wear a headset or hold the cellphone to the ear on the opposite side of your pacemaker. Carry the phone on the opposite side as well.
- **Electromagnetic antitheft systems** are often found near store entrances and exits. Walking through one is okay. However, avoid standing near or leaning against one.
- **Very strong magnets** should be avoided. These include those in big speakers (such as those at concerts) and in handheld security wands. Talk to your doctor before scheduling an MRI (a test that uses strong magnets).
- **Strong electrical fields** can be created by radio towers and heavy-duty power equipment (such as an arc welder). Car engines also create an electrical field while they're running. Avoid leaning over the hood of a running car.



▶▶ When talking on a cellphone, wear a headset or hold the phone on the side opposite your pacemaker.

## How a Pacemaker Can Help

A pacemaker helps keep your heart from beating too slowly. This reduces symptoms of a slow heartbeat. It can also enable you to take medications that would otherwise slow your heartbeat too much. Best of all, a pacemaker can let you be more active.

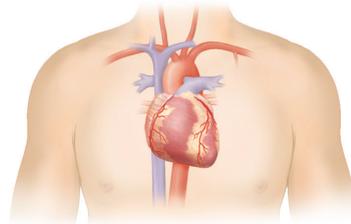
## Your Role

A pacemaker can make a big improvement in how you feel. But having one is a lifelong commitment. Work with your doctor to decide whether a pacemaker is right for you. You may have other options or things to consider. Know what you will need to do to care for the device and how often it needs to be checked and monitored. Be sure to mention concerns and get answers to any questions you have. By being informed, you can help your doctor ensure you get the care you need.



# The Heart's Electrical System

The heart is a muscle that pumps blood throughout the body. The heart's electrical system tells it when to **contract** (squeeze). If there's a problem with this electrical system, the heart may not beat as often as it should. This means that the heart can't pump the amount of blood that the body needs.



▶▶ Be sure to keep your follow-up appointments and do home checks as often as directed.

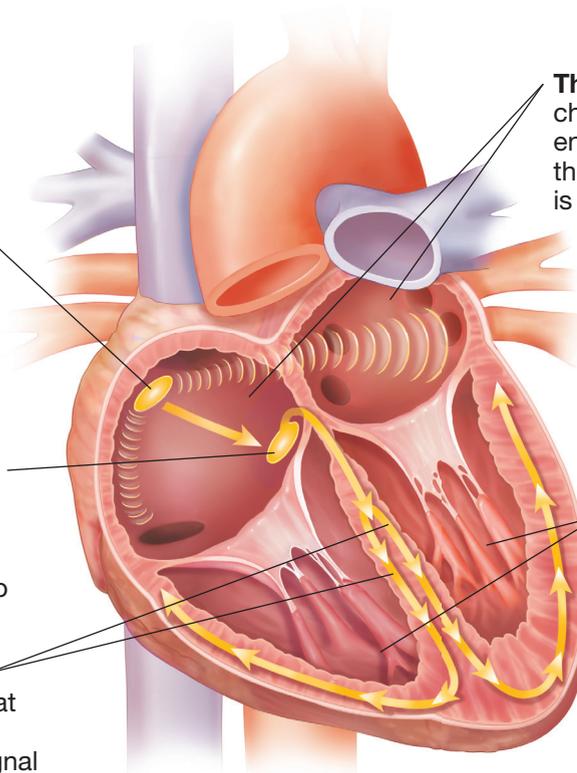
## Signals Tell the Heart to Beat

Each heartbeat starts with an electrical signal. The signals are sent and received by special electrical cells in the heart called **nodes**. As the signals move through the heart, they tell the chambers that pump blood (called **atria** and **ventricles**) when to contract. With physical activity, the signals from the nodes speed up to pump blood faster. During rest, the signals return to a normal speed.

**The SA (sinoatrial, or sinus) node** is the heart's natural pacemaker. It starts each heartbeat by sending an electrical signal that tells the atria to contract.

**The AV (atrioventricular) node** receives the signal from the SA node after it passes through the atria. It then guides the signal to the ventricles.

**The bundle branches** are pathways of cells that carry the signal through the ventricles. As the signal moves through the ventricles, they contract.



**The atria** are the upper chambers where blood enters the heart. When the atria contract, blood is sent to the ventricles.

**The ventricles** are the heart's lower chambers. They contract to pump blood out of the heart.

## Checking Your Pacemaker from Home

You may be able to have your pacemaker checked from home. This is done using a special device. The device lets you send signals from your pacemaker over the phone line or wirelessly. Your doctor then reviews this information. He or she will let you know if you need to come in for an adjustment. If you have any symptoms of a slow heartbeat, be sure to tell your doctor.



▶▶ You may send your pacemaker readings to your doctor using a phone line or wireless connection.

## Replacing the Battery or Leads

Most pacemaker batteries last for 5 to 10 years. If the battery begins to run low, the pacemaker sends out a signal that can be read. It may also have an alarm that sounds or vibrates to signal a low battery. In either case, there is plenty of time to replace the pacemaker. If the battery is low, the whole generator must be replaced. This is done with a procedure that is simpler and shorter than the first implantation. Leads rarely wear out. If they do need to be replaced, it is done during a procedure similar to the first implantation.



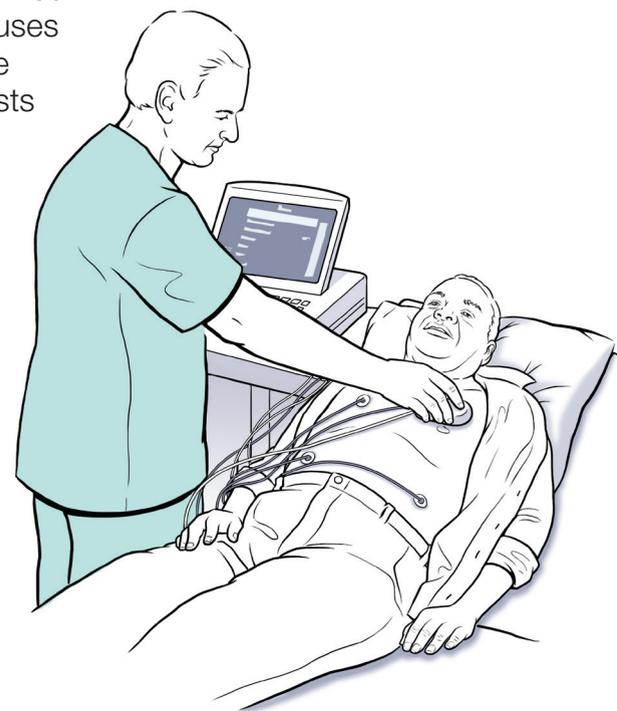
Your pacemaker's functions and battery will be checked regularly throughout the year. If needed, its settings can be adjusted. This helps ensure the pacemaker is always doing its best for your heart. Your pacemaker can be checked in person during follow-up visits and through remote checks from home.

## Reading the Pacemaker

During follow-up visits, your doctor will check the information stored on your pacemaker's computer. This is done by placing an electronic wand over the skin where the pacemaker is implanted. It will not cause any pain. The battery inside the pacemaker is also checked.

## Making Adjustments

Over time, the pacemaker's settings may need to be adjusted. At each visit, tell your doctor how the pacemaker is working for you. Are you able to do all the activities you want? Or do you often feel tired? To adjust the settings, your doctor uses a device called a programmer. This device reads the pacemaker's memory and adjusts the settings using radio signals.



▶▶ The pacemaker's settings are adjusted from outside your body.

## Problems with Electrical Signals

A slow heartbeat is often due to problems with the SA node or AV node. The heartbeat may be slow only once in a while or all the time. In some cases, the heartbeat doesn't speed up during physical activity.

### Sick Sinus Syndrome

The main problem that affects the SA node is called sick sinus syndrome. It can cause:

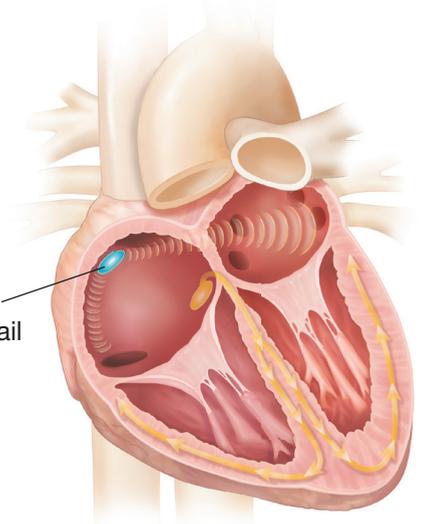
- **Sinus bradycardia.** The SA node sends out signals too slowly.
- **Sinus pause.** The SA node fails to create a signal. Without a signal, the atria don't contract.

**Tachy-brady syndrome** is a type of sick sinus syndrome. The heartbeat switches between very fast and too slow.

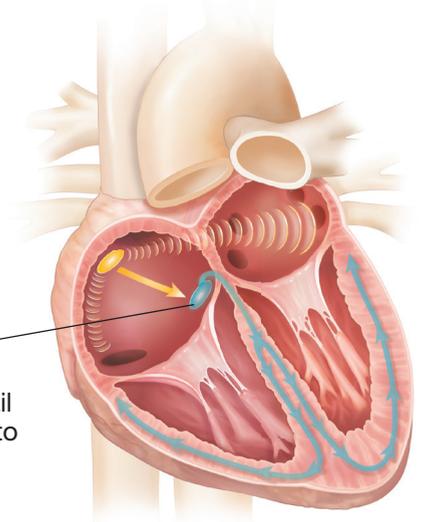
### AV Block ("Heart Block")

Heart block occurs when the AV node has problems passing on electrical signals from the SA node to the ventricles. It can be caused by problems with either the AV node or the bundle branches. If the ventricles don't receive a signal, they don't contract. This may happen only once in a while. Or, the signal may be blocked all the time.

With **sinus pause**, the SA node may fail to create a signal.



With **heart block**, the AV node or bundle branches fail to pass on signals to the ventricles.



# Understanding Pacemakers

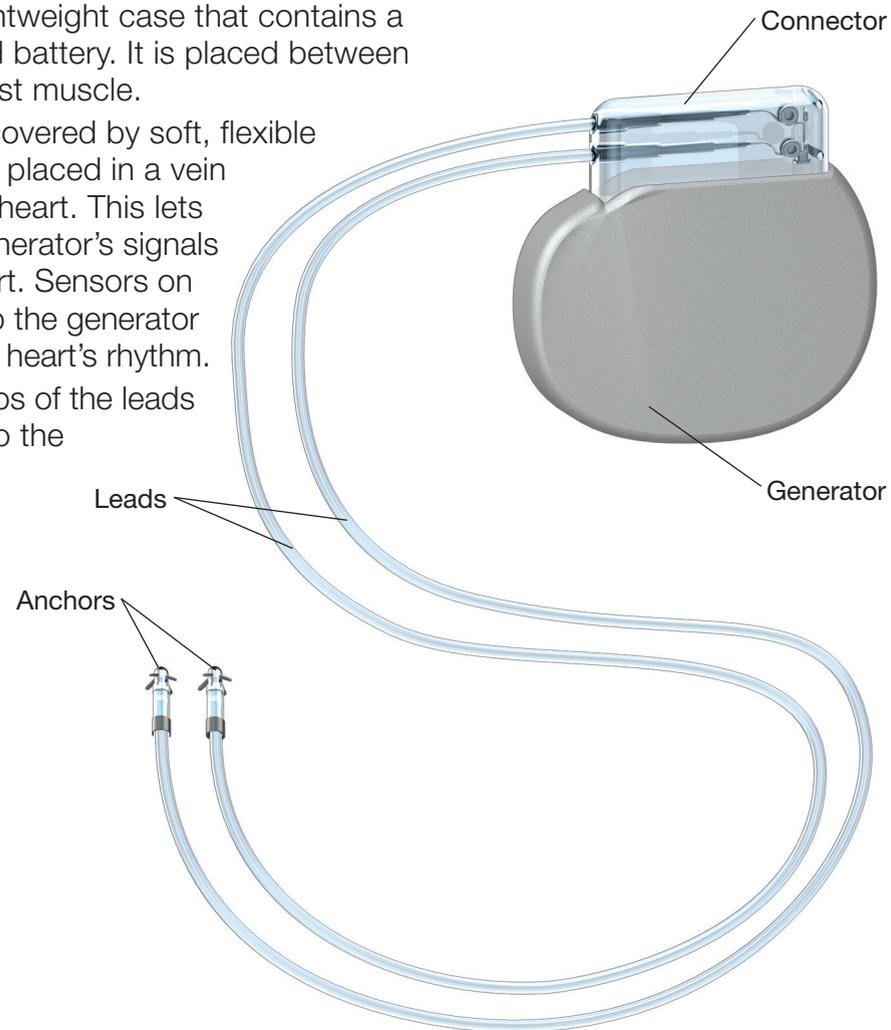
Before you go home, be sure to know how to reach your doctor in case you have a problem.



A pacemaker is a small, lightweight electronic device. It contains a tiny computer. It tracks the speed of the heartbeat. If the heart beats too slowly, it sends electrical signals to the heart. These signals “pace” the heart to keep the heartbeat at a minimum speed. Sensors in the pacemaker also keep track of the body’s activity level and can adjust the signals as needed.

## The Parts of a Pacemaker

- **The connector** (header) is the part of the generator where the lead or leads are attached.
- **The generator** sends out electrical signals. It has a smooth, lightweight case that contains a tiny computer and battery. It is placed between your skin and chest muscle.
- **Leads** are wires covered by soft, flexible material. They are placed in a vein that goes to your heart. This lets them carry the generator’s signals directly to the heart. Sensors on the leads also help the generator keep track of your heart’s rhythm.
- **Anchors** on the tips of the leads attach the leads to the heart muscle.



## Caring for Your Incision

- Change or remove the dressing as instructed.
- Keep the incision clean and dry. You may be told to take sponge baths at first. You can begin showering when your doctor says it’s okay.
- Don’t scrub the incision as you bathe. Also, don’t let water spray directly on the incision.
- Pat the incision dry. Don’t use lotion, ointment, or powder on the incision while it heals.
- Call your doctor if you notice any changes in the incision, such as signs of infection (see below).



## When to Call the Doctor

*Call if you have any of the following after your procedure:*

- Signs of infection at the incision site, such as increasing redness, swelling, warmth, or drainage
- Fever of 100.4°F (38°C) or higher
- Pain around your pacemaker that gets worse, not better
- Bleeding or severe swelling of the incision site (bulging up like a golf ball)
- Swelling in the arm or hand on the side of the incision site
- Twitching chest or abdominal muscles
- Frequent or constant hiccups
- Chest pain or shortness of breath





**You will likely stay in the hospital overnight. Before going home, you'll be given instructions for how to care for yourself. If you have questions, ask your doctor or nurse. To help your recovery, follow all of your doctor's instructions.**

## In the Hospital

After the procedure, nurses will monitor your heart signals and check your incision. They can also provide medications for pain. Be sure to tell the nurses if you have any chest pain, shortness of breath, twitching, or hiccups. Once you're stable, you'll be moved to a hospital room. There, your pacemaker's functions and settings may be checked. You'll also have a chest x-ray to ensure the leads are in the correct location. You can go home once your doctor says it's okay. Have an adult family member or friend ready to drive you.

## Recovering at Home

- You may be told to restrict how high you raise the arm on the side where the generator was implanted. Don't stop using the arm or shoulder completely. You can go back to normal use in time.
- You may have bruising at the incision site for about a month. This is normal. It will go away as the incision heals.
- It's normal to have some pain and stiffness around your incision for a few days. Over-the-counter pain medications can often help. If needed, your doctor may also prescribe pain medications.
- You can often get back to your normal routine soon after implantation. Ask your doctor when you can return to work.
- You may be instructed not to drive for a certain amount of time. Your doctor will tell you more about this.



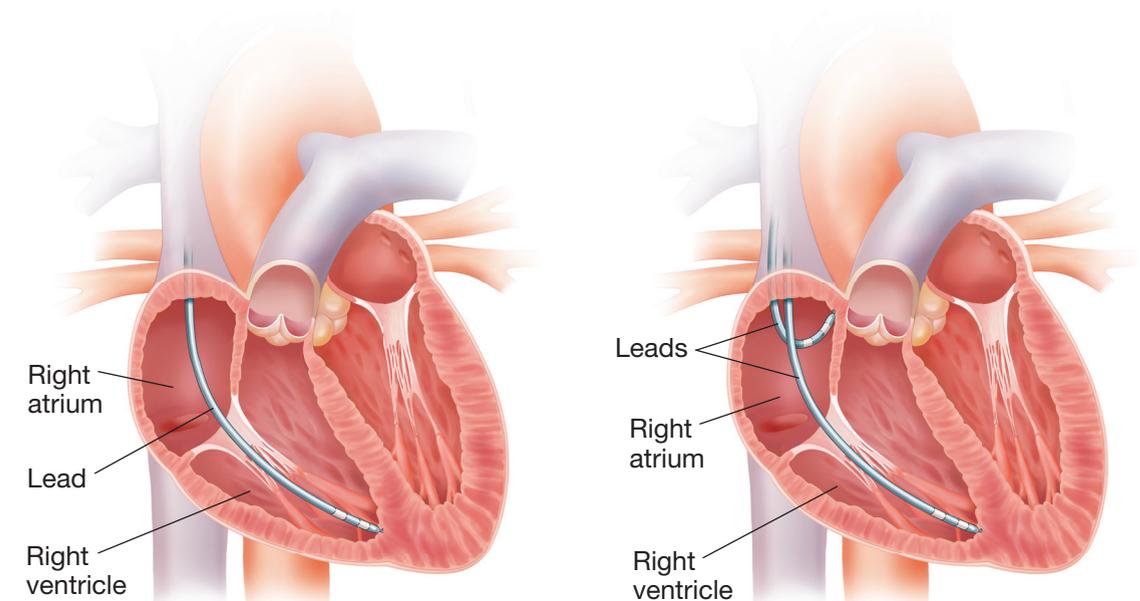
▶▶ If you're told to limit raising your arm, ask for help reaching things above shoulder level.

## Types of Pacemakers

You and your doctor will discuss the type of pacemaker that's best for you. Most pacemakers have one or two leads. If you have a condition called heart failure, you may be given a pacemaker with three leads instead.

## How a Pacemaker Adapts to Your Needs

When you're active, your heart beats faster to meet the body's need for more blood and oxygen. Problems with the heart's electrical system can prevent the heart from speeding up. To address this problem, all pacemakers have a **rate-responsive** feature. This means they can automatically adjust your heart rate as needed. The pacemaker speeds up when you're active. It returns to a normal speed when you're resting.



**A single-chamber pacemaker** has one lead. The lead is usually put into the right ventricle. The exact placement inside the ventricle may vary.

**A dual-chamber pacemaker** has two leads. One is in the right atrium. The other is in the right ventricle. Having two leads helps coordinate the signals that tell these chambers when to contract.

# The Implantation Procedure

Placing a pacemaker inside the body is called **implantation**. This is **not open heart surgery**. It's a relatively minor procedure done in an **operating room or cardiac catheterization lab**. A pacemaker can be implanted in either side of the chest but is most often placed on the **left side**. The procedure usually takes **1 to 2 hours**.

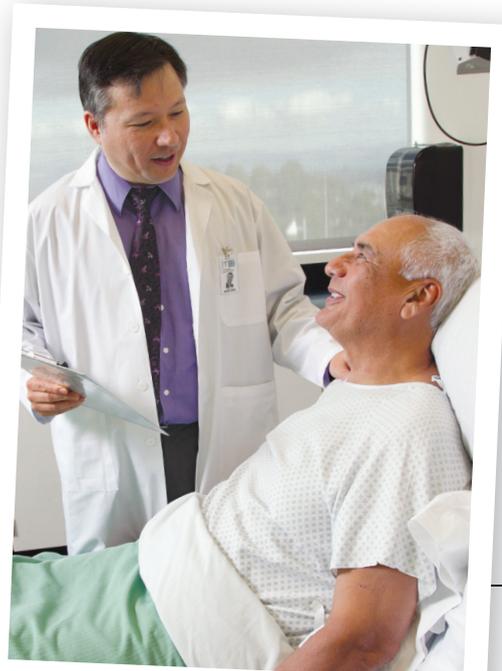
## Getting Ready for the Procedure

- Have tests that your doctor recommends.
- Tell your doctor about all prescribed medications you take. Be sure to mention medications to prevent blood clots. These include daily aspirin and drugs such as warfarin. Also be sure to mention diabetes medications such as insulin. You may be given special instructions for these.
- Also tell your doctor about all over-the-counter medications, herbal remedies, or supplements you use. Mention if you take pain relievers, such as NSAIDs.
- Talk to your doctor about which side of your chest the pacemaker is to be implanted in. Tell the doctor if you're left-handed or right-handed. Also mention if you often do activities that involve the chest and shoulder, such as shooting a rifle.
- Don't eat or drink anything as instructed before your procedure.

## Before Implantation

On the day of your procedure, here's what to expect:

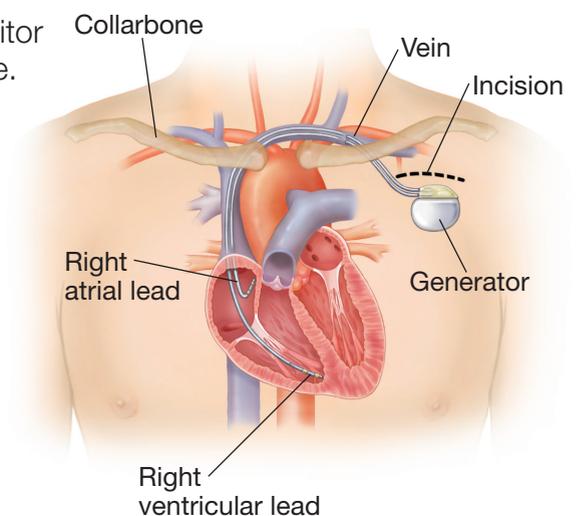
- You will be asked your name and procedure more than once. This is for your safety.
- An IV is put into your hand or arm to provide fluids and medication. You may be given medication to help you relax.
- Anesthesia is given to prevent pain and make you sleep during the procedure. You may be lightly asleep (conscious sedation) or in a state like deep sleep (general anesthesia).



## During the Procedure

The most common method for implanting a pacemaker is called endocardial ("inside the heart") implantation. This means that the leads run directly from the generator to the inside of the heart. In rare cases, the leads are attached to the outside of the heart. To implant the pacemaker:

- **Medications are given** to prevent pain. A local anesthetic is used to numb the site where the pacemaker is implanted. You may also be given medications to help you relax or sleep.
- **An incision is made** beneath the collarbone. A small "pocket" for the generator is created between the skin and the chest muscle.
- **The leads are put through the incision** into a vein in the upper chest. The leads are guided into your heart. An x-ray monitor shows the leads as they move into place.
- **The leads are attached to the heart** using small anchors on the tips of the leads. Electrical measurements are done to find the best placement for the leads.
- **The generator is attached to the leads.** Once the leads are secure, the generator is placed in the pocket beneath your skin.
- **The incision is closed** with sutures, surgical glue, or staples. You'll then be taken to a recovery area.



## Risks and Complications

*Like any procedure, pacemaker implantation has risks. These include:*

- Bleeding or blood clots
- Infection
- Severe bruising or swelling at the incision site
- Puncture of the lung or heart muscle
- Tearing of the vein or artery wall
- Need to have leads or generator repositioned or replaced
- Heart attack, stroke, or death

