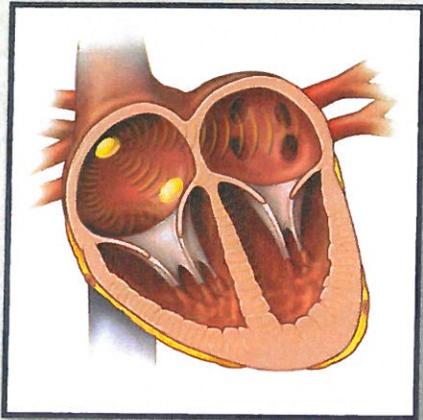
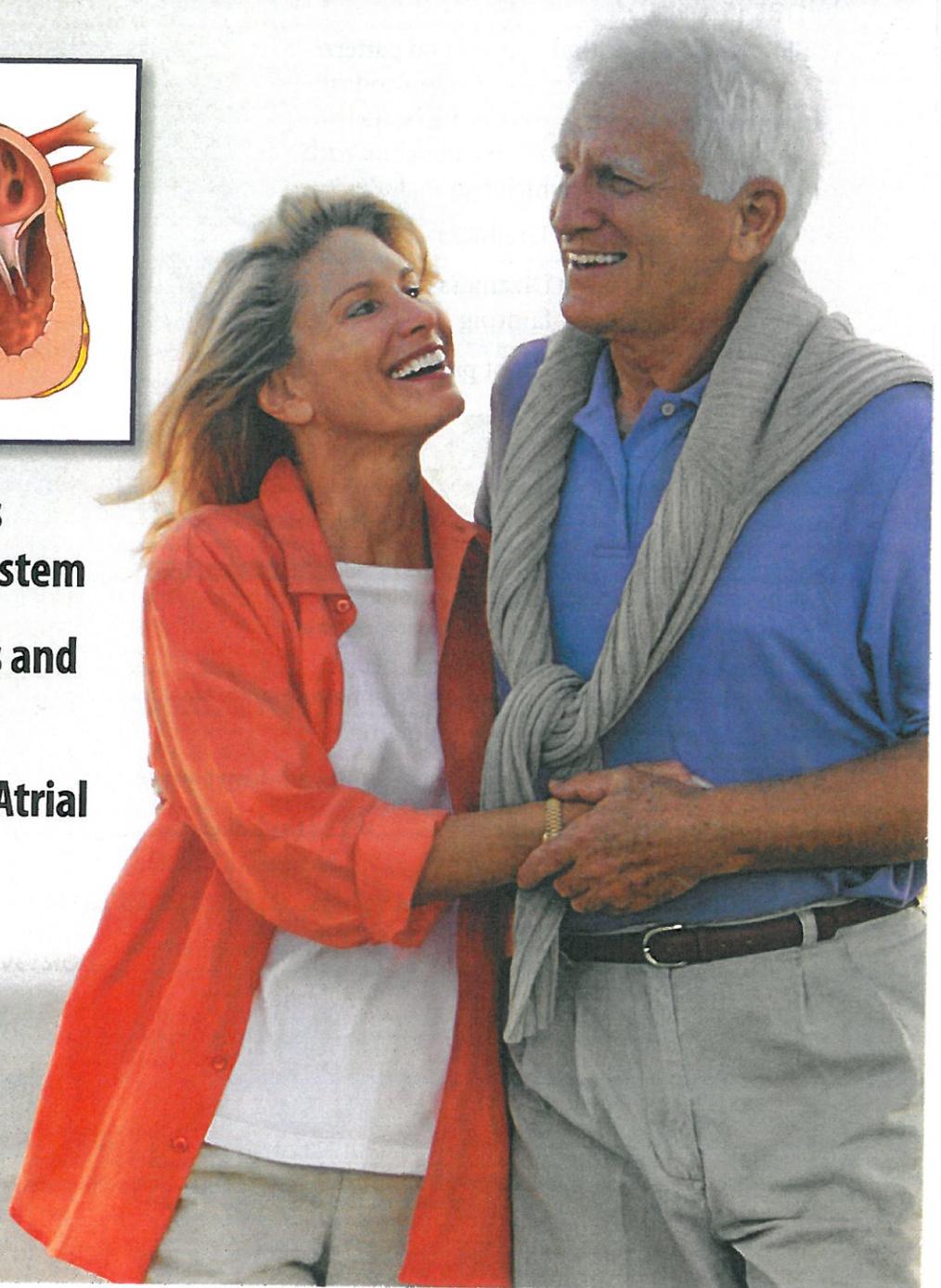


# Understanding Atrial Fibrillation



- **Your Heart's Electrical System**
- **Medications and Procedures**
- **Living with Atrial Fibrillation**



# When You Have Atrial Fibrillation

You've been told you have a heart condition called **atrial fibrillation** (also called A-fib or AF). Hearing you have a heart problem can be scary. But here's the good news: A-fib is a common condition that can be managed. And it's rarely life-threatening. Read on to learn how you can control your A-fib and live a normal, active life.

## What Is A-Fib?

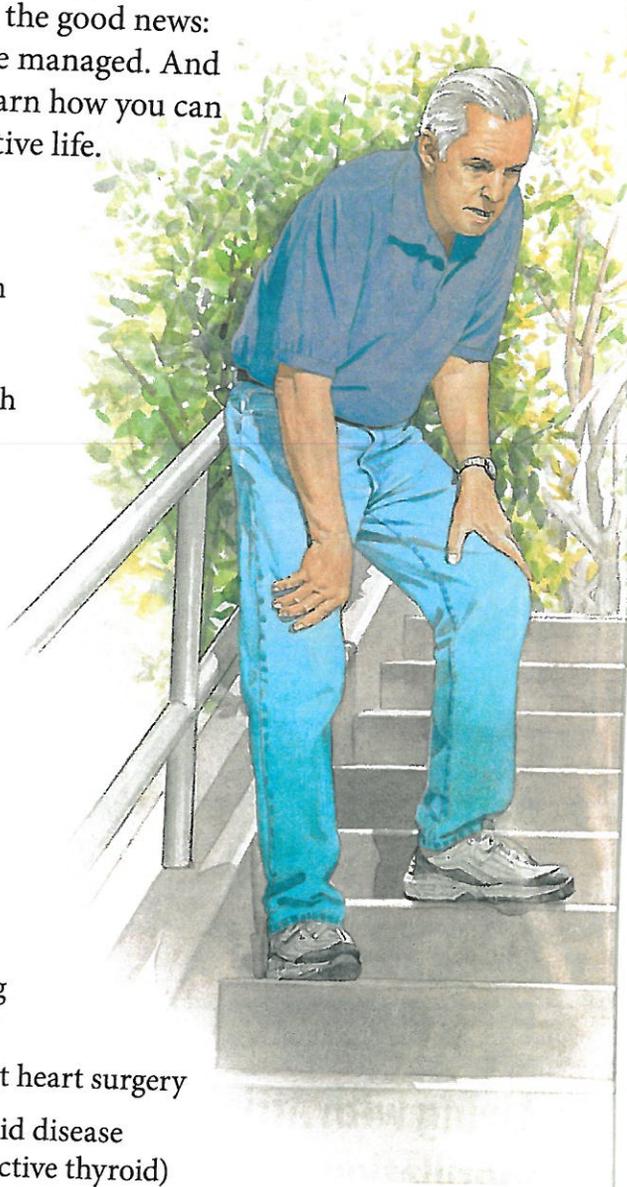
A-fib is a problem with the speed and pattern of your heartbeat. It can occur in episodes. These are periods when your heart beats in a fast and irregular way. A-fib can occur with or without symptoms, which can include:

- A pounding, irregular heartbeat
- Shortness of breath
- Tiredness
- Dizziness or fainting
- Chest pain

## Risk Factors for A-Fib

Risk factors are things that make a person more likely to have A-fib than other people. A-fib can occur without risk factors. For instance, A-fib without underlying heart disease is called **lone A-fib**. But more often, people with A-fib have risk factors. Your risk of having A-fib increases with any of the following:

- Age over 60 years old
- A heart condition, such as coronary artery disease, heart valve disease, or heart failure
- High blood pressure
- Lung disease
- Diabetes
- Recent heart surgery
- Thyroid disease (overactive thyroid)
- Certain sleep problems, such as sleep apnea
- Obesity
- Heavy alcohol drinking



This booklet is not intended as a substitute for professional medical care. Only your doctor can diagnose and treat a medical problem.

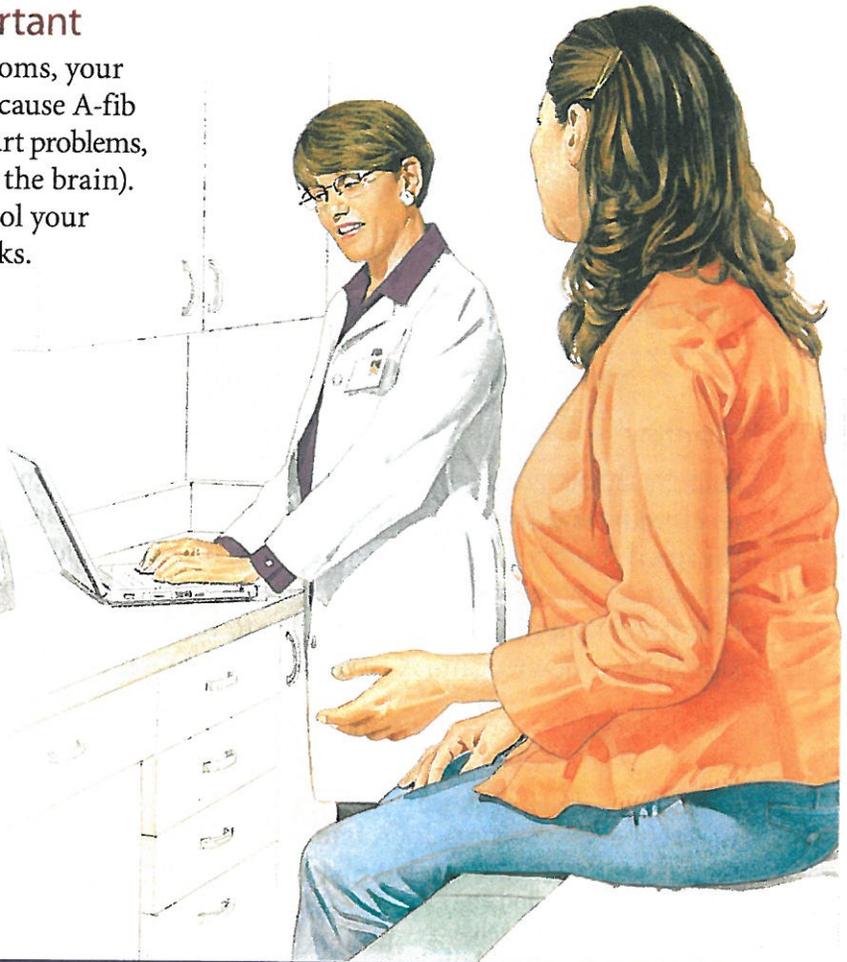
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## Why Treatment Is Important

Whether or not you have symptoms, your A-fib needs treatment. This is because A-fib can increase your risk of other heart problems, as well as **stroke** (a blood clot in the brain). With proper care, you can control your condition and decrease these risks.

## Working with Your Doctor

There are different types of A-fib. And the severity of A-fib symptoms differs from person to person. So, a variety of treatments are available. Your healthcare provider will help you understand your treatment options. Then you can work together to create a treatment plan that's right for you.



## In This Booklet

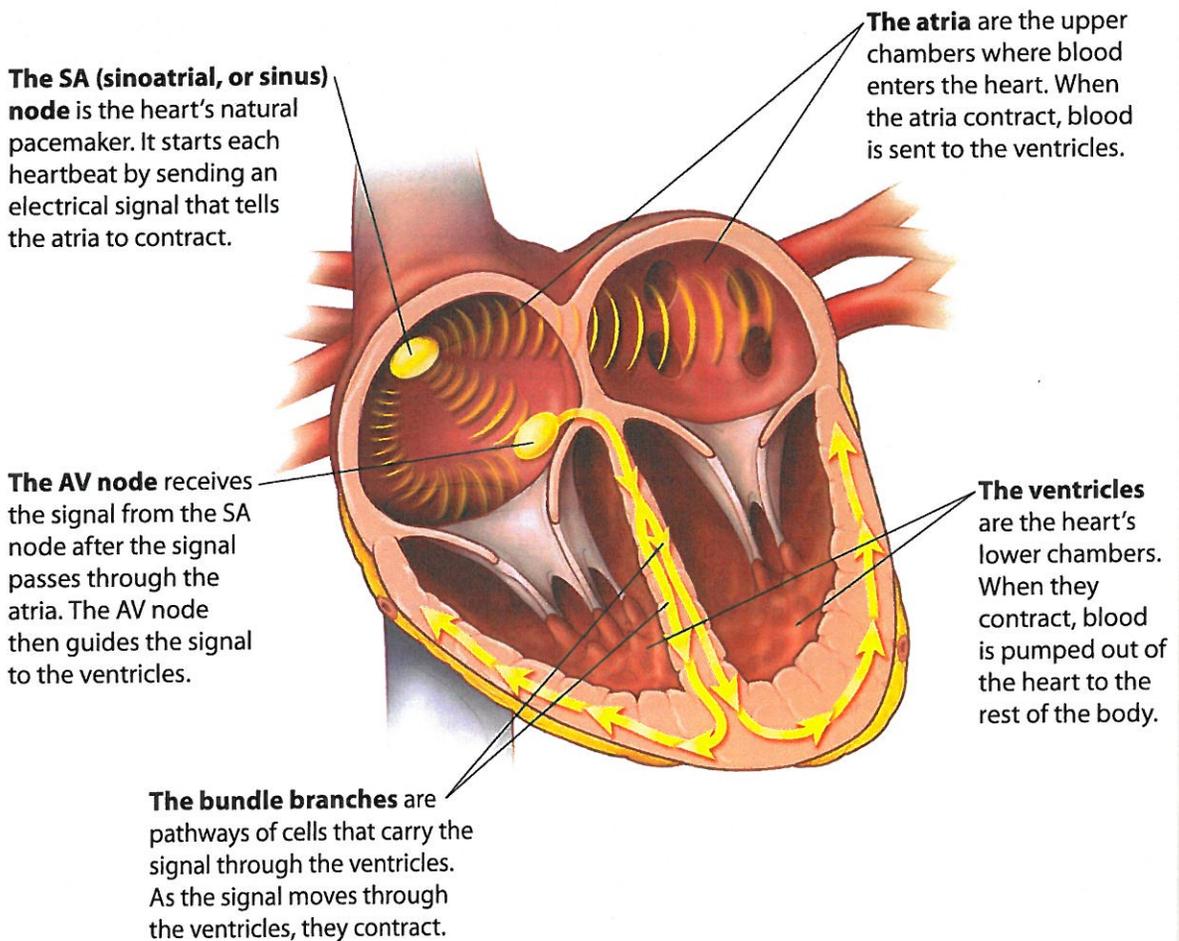
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# Understanding Your Heartbeat

The heart is a muscle that pumps blood throughout the body. As the heart pumps, chambers in the heart relax and squeeze (contract). When the heart relaxes, it fills with blood. When it contracts, the heart empties this blood. These actions move blood through the heart and make up the **heartbeat**. The number of heartbeats per minute (bpm) is called the **heart rate**. The pattern of the heartbeats is called the heart **rhythm**. An **arrhythmia** is a problem with the heart's rate and/or rhythm. A-fib is one type of arrhythmia.

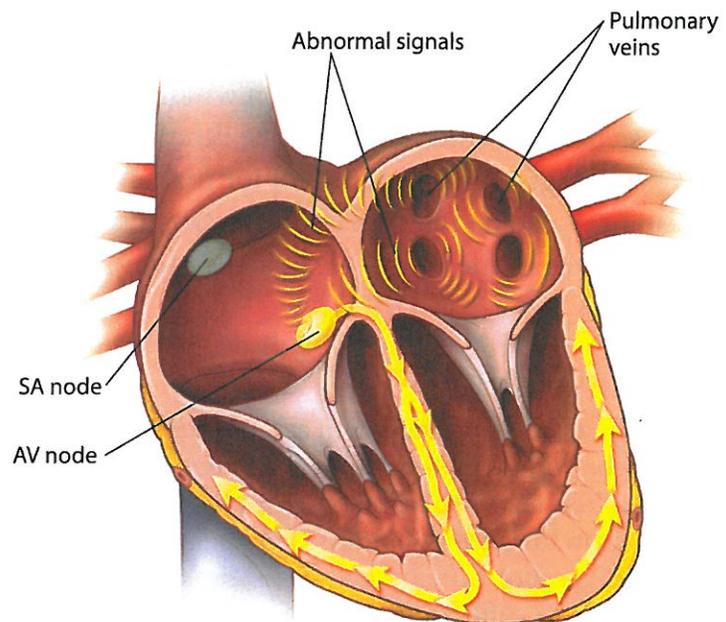
## Electrical Signals Tell the Heart to Beat

Each heartbeat starts with an electrical signal. These signals are sent and received by special cells in the heart called **nodes**. As signals move through the heart, they tell the heart's chambers (the **atria** and **ventricles**) when to contract. When you're active, the signals speed up. This makes the heart beat faster so it can send more oxygen to the body. When you're resting, the signals slow down again. A normal resting heart rate is about 50 to 100 bpm.



## During an A-Fib Episode

During A-fib, the atria receive abnormal electrical signals. These signals are most often sent by cells in the **pulmonary veins** (blood vessels that carry blood from the lungs to the heart). The abnormal signals travel from the atria to the AV node and the ventricles. The signals cause both the atria and the ventricles to contract in a fast and irregular way. The atria may reach up to 350 to 600 bpm, while the ventricles may reach about 150 to 200 bpm. These different contraction rates cause an abnormal heart rhythm.



## How A-Fib Can Cause Symptoms and Stroke

During an A-fib episode, the atria beat too fast to properly pump blood into the ventricles. So, less blood than normal may be pumped out of the atria and to the body. This can cause symptoms, such as feeling tired, dizzy, or out of breath. Meanwhile, the blood that is not pumped to the ventricles can pool in the atria. This pooled blood can clot. If clots move out of the heart to the brain, this can cause a stroke.

## Types of A-Fib

There are three types of A-fib:

- **Paroxysmal A-fib** involves episodes that last less than 7 days. They start and stop on their own.
- **Persistent A-fib** involves episodes that last longer than 7 days. They typically require treatment to stop them.
- **Permanent A-fib** is when A-fib is ongoing and resists most treatment attempts.

---

## Atrial Flutter

Some people who have A-fib also have **atrial flutter**, another type of arrhythmia. With both A-fib and atrial flutter, the heart beats in a fast and uneven way. In fact, an episode of atrial flutter may feel like A-fib. And stroke risk is the same for both conditions. Unlike A-fib, many cases of atrial flutter start in the right atrium rather than the left atrium. Treatment results also differ. Medications typically treat atrial flutter as well as they treat A-fib. But catheter ablation (see page 12) is more often successful for atrial flutter than for A-fib.

## Your Medical Evaluation

Your healthcare provider will gather information about your heart and your health. This evaluation will likely include a health history, physical exam, and tests. Your healthcare provider may refer you to a cardiologist (heart specialist) for further evaluation and treatment. You may also be referred to an electrophysiologist (doctor who specializes in the heart's electrical system).

### Health History

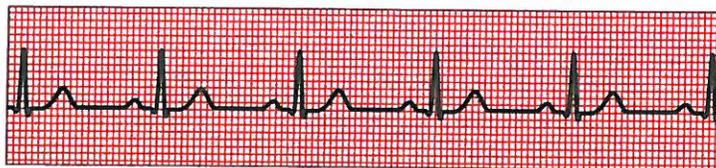
Your healthcare provider will ask you to describe your symptoms and when they occur. You may also be asked about things that seem to cause symptoms. These may include alcohol, caffeine, and stress. Be sure to tell the healthcare provider about your family medical history. Also mention other health problems you have, such as sleeping problems. And tell the healthcare provider about any prescription or over-the-counter medications you're taking.

### Physical Exam

The healthcare provider will take your blood pressure and pulse. He or she will listen to your heart, lungs, and blood vessels for sounds that may indicate an abnormal heart rhythm or restricted blood flow. You may also be checked for signs of other heart problems and for thyroid disease.

### Electrocardiogram

You will likely have an **electrocardiogram (ECG)**. This test records the electrical activity of your heart. During an ECG, small pads (electrodes) are placed on your chest, arms, and legs. Wires connect the pads to a machine, which records your heart's electrical signals. An ECG records heart signals for just a few seconds, so it shows A-fib only if the test takes place during an episode. As a result, an ECG may not be able to detect cases of paroxysmal A-fib.



**An ECG of a normal heartbeat.** A new beat starts near each tall peak. Note that the heartbeats are evenly spaced. This shows that the heart rhythm is regular.

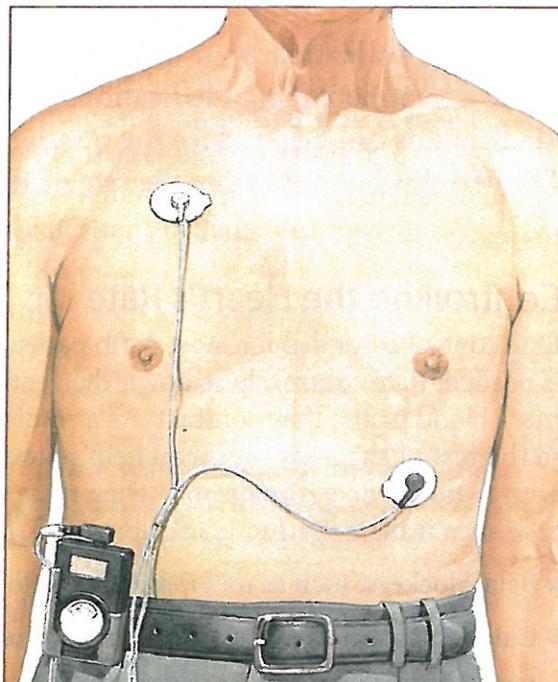


**An ECG of a heartbeat during A-fib.** The tall peaks are closer together than in the normal heartbeat. This shows that the heartbeat is faster than normal. The uneven spaces between the taller lines show that the heart rhythm is irregular.

## Heart Monitors

To help diagnose paroxysmal A-fib, external heart monitors may be used. Like a regular ECG, they record heart activity. But they're portable and record for a longer length of time. They include these types:

- **Event monitors** can be used for 3 to 4 weeks. One kind is a memory loop recorder. This monitor records constantly, but stores the recording only when you press a button. The other kind is a credit card-sized recorder. This monitor is turned on only during an episode. With both monitors, you send the recordings of symptoms to your healthcare provider over the phone.
- **Holter monitors** can be worn for 1 to 7 days. They provide a constant recording of heart activity. After the test is done, your healthcare provider analyzes the recording.

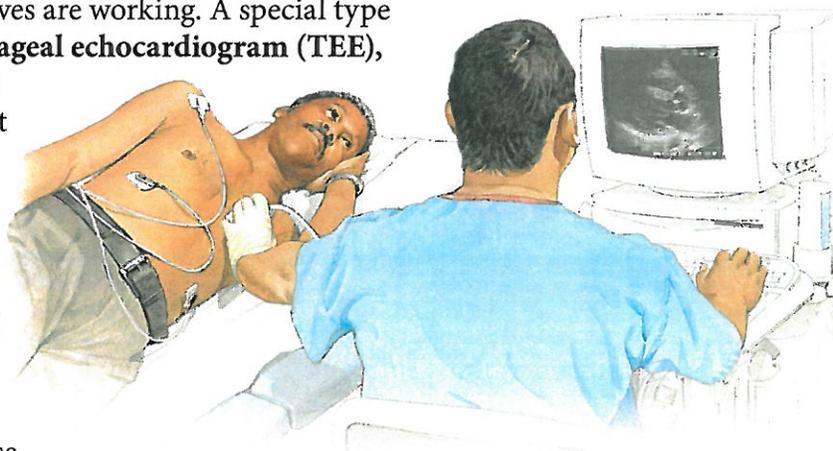


With a **memory loop recorder**, information about your heart's activity is sent to a small recording device. The device is connected to the chest by wires and electrodes.

## Other Tests for A-Fib

Other tests may be done, such as the following:

- An **echocardiogram (echo)** uses sound waves to create a moving picture of the heart. It shows the size and shape of the heart. It also shows how well heart chambers and valves are working. A special type of echo, called a **transesophageal echocardiogram (TEE)**, is sometimes done. This test works from inside your chest using a tube put down your throat. A TEE gives more detail than a regular echo.
- **Blood tests** may be done to check things such as thyroid function.
- **Other testing** may be done to check heart function. These tests include stress tests done using an ECG, an echo, or nuclear imaging.



During an echocardiogram, a probe moved over the chest emits harmless sound waves to create a picture of the heart.

## Medications for A-Fib Symptoms

After your evaluation, your healthcare provider will work with you to create a treatment plan. Medications will likely be a part of this plan. Medications can help reduce the number and length of A-fib episodes. They do this by controlling the rate or the rhythm of the heartbeat.

### Controlling the Heart's Rate

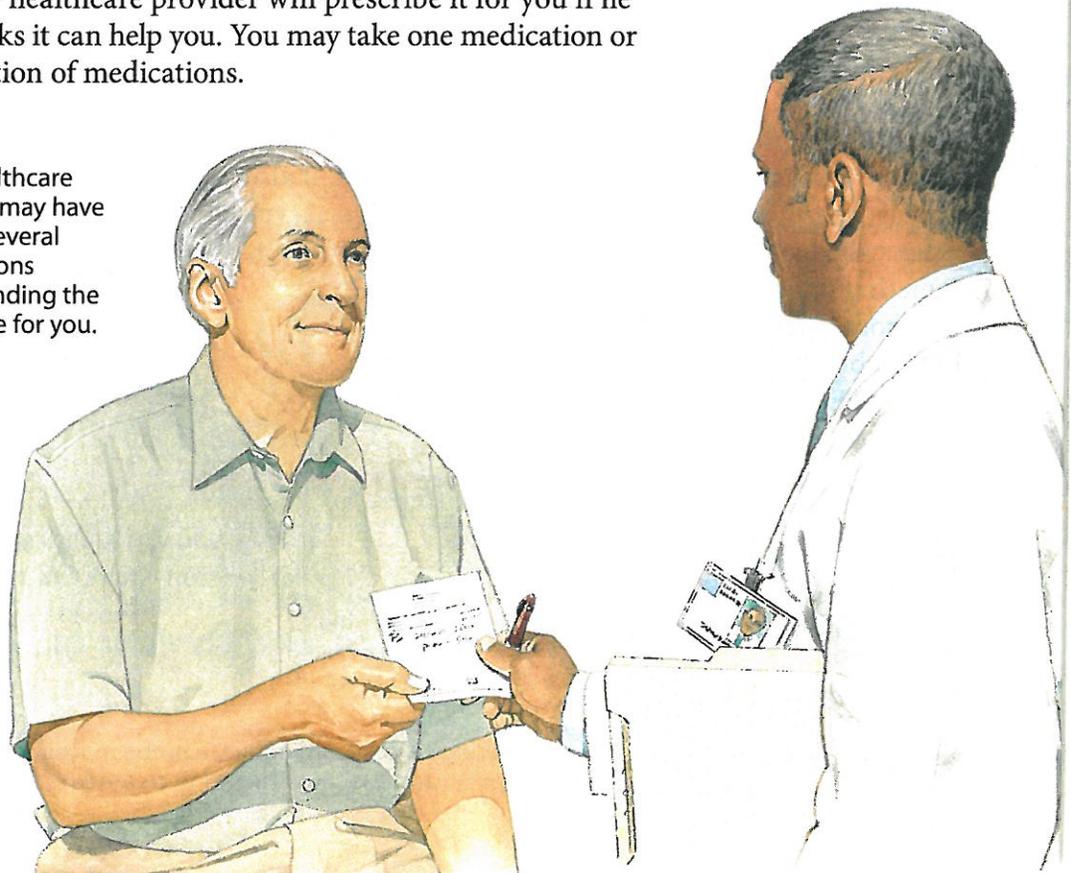
Rate control is needed for most A-fib patients, whether or not rhythm control is needed. Rate control slows down the ventricles. This allows them to fill with more blood before they contract. As a result, the ventricles pump more blood to the rest of the body. This can help relieve A-fib symptoms. Most people with A-fib can live comfortably when their heart rate is under control. This is true even if their rhythm is still abnormal. Rate control medications include:

- Beta-blockers, such as metoprolol, atenolol, carvedilol, and bisoprolol
- Calcium channel blockers, such as diltiazem and verapamil
- Digoxin

### How Rate Control Medication Is Given

Rate control medication is usually taken daily on an ongoing basis. Your healthcare provider will prescribe it for you if he or she thinks it can help you. You may take one medication or a combination of medications.

Your healthcare provider may have you try several medications before finding the right type for you.



## Controlling the Heart's Rhythm

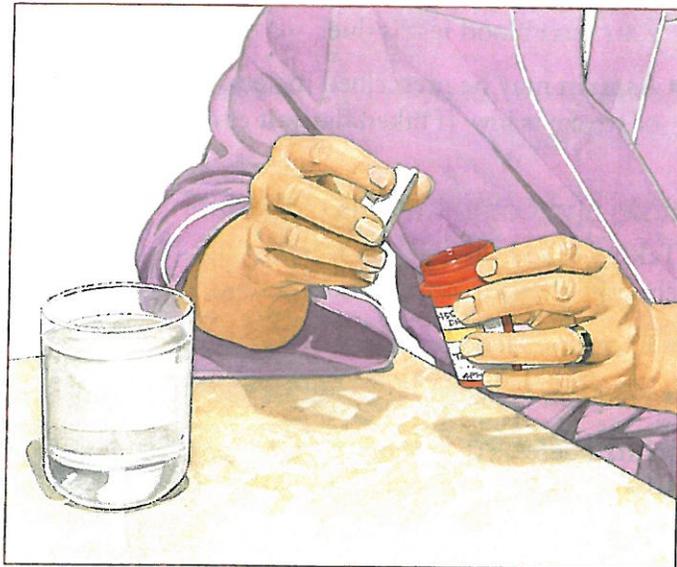
Your healthcare provider may suggest rhythm control medications (antiarrhythmics). These drugs can help restore a normal rhythm during an A-fib episode (this is called **chemical cardioversion**). They can also help maintain a regular heart rhythm. Like rate control, rhythm control helps the heart pump in a more efficient way. This can help reduce A-fib symptoms. Rhythm control medications include:

- Amiodarone
- Flecainide
- Propafenone
- Sotalol
- Dofetilide

### How Rhythm Control Medication Is Given

Rhythm control medication is often given for the first time at a doctor's office, hospital, or clinic. (You may need to take anti-clotting medication beforehand to help prevent a stroke. See page 10.) Rhythm control medication may be given by injection or taken as a pill. Your body's response to the medication is monitored. This makes sure it works for you. After this initial use, rhythm control medication may be taken in one of two ways:

- **Daily.** If you have frequent A-fib episodes, you may take rhythm control medication daily on an ongoing basis to help prevent episodes.
- **As needed.** If you have infrequent A-fib episodes and no other heart disease, you may use "pill-in-the-pocket" treatment. This means you carry medication with you and take it when an A-fib episode occurs. **Note:** This medication can cause other arrhythmia problems, so take it only as instructed by your healthcare provider.



### Common Side Effects of A-Fib Medication

Side effects depend on what type of medication you take. Side effects of medications used for rate control and rhythm control may include:

- Constipation
- Dizziness
- Fatigue
- Swelling of the legs
- Nausea and vomiting
- Erectile dysfunction

## Medications for Preventing Stroke

A critical part of your A-fib treatment plan is preventing stroke. Your healthcare provider will likely prescribe medication for this purpose. Your stroke risk is not related to the type of A-fib you have. Instead, other factors, such as having certain health problems, affect how likely you are to have a stroke.

### Types of Medications

The type of medication you're given depends on your stroke risk. Two types of anti-clotting medications are used to help prevent stroke:

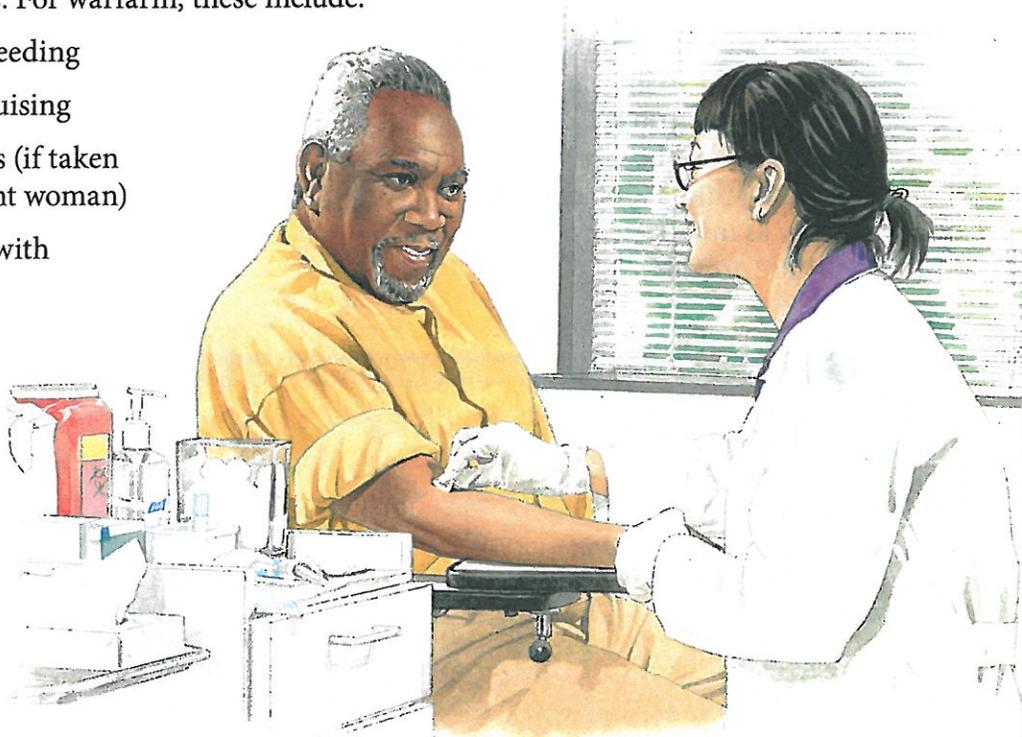
- **Warfarin** is a commonly used blood thinner (anticoagulant). When taking warfarin (brand name Coumadin), you'll need to have regular blood tests to make sure the dosage is correct. The blood test you'll have is called a prothrombin time (also called a protime or PT). It shows how quickly your blood clots. The result of the test is called your INR number. When taking warfarin, you should always know your current warfarin dosage, your INR number, the date of your last blood test, and when your next blood test is due.
- **Aspirin** may be prescribed instead of warfarin for patients whose risk of stroke is low. If taken daily, it can help prevent stroke.

### Risks and Complications of Warfarin

Taking blood thinners has certain risks and possible complications. For warfarin, these include:

- Excessive bleeding
- Frequent bruising
- Birth defects (if taken by a pregnant woman)
- Interaction with other drugs

When taking warfarin, you need to get your blood tested regularly.



# Electrical Cardioversion

If medications don't do enough to reduce your A-fib symptoms, your healthcare provider may suggest **electrical cardioversion (EC)**. This procedure uses electric current to "shock" your heart back into normal rhythm. It is most often used to treat persistent A-fib.

## Preventing Clots

Before the procedure, you may have preventive treatment to make sure there are no blood clots in your heart. This may include taking a prescribed amount of warfarin for about a month. Or you may have a TEE done (see page 7).

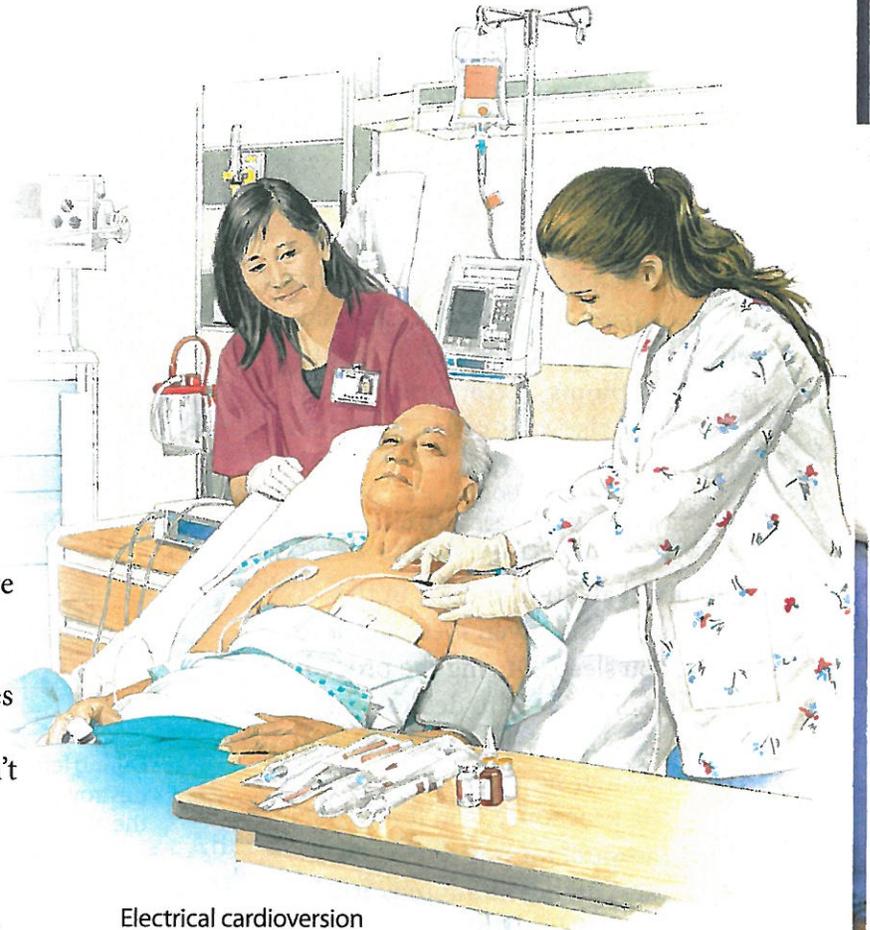
## How the Procedure Works

EC is done in the hospital. You're given medication to make you sleep. Special pads (electrodes) placed on your chest and paddles are used to send a brief electric shock to your heart. If EC doesn't work the first time, it may need to be repeated during the same session. You'll likely go home 2 to 3 hours after the procedure.

## Risks and Complications

EC has risks and possible complications. These include:

- Anesthesia side effects
- Mild skin burn (rare)
- Stroke (rare)



Electrical cardioversion often takes just a few minutes.

## When to Call the Doctor

After EC, be sure to call your healthcare provider if you have any of the following:

- Return of A-fib soon after the procedure
- Shortness of breath
- Dizziness
- Symptoms of stroke

# Catheter Ablation

A procedure called **catheter ablation** can help treat A-fib. During this procedure, a wire (catheter) is sent into a blood vessel, typically at the groin. The wire travels through the blood vessel into the heart. It then uses energy to destroy (ablate) certain cells in the heart. This lessens A-fib symptoms. There are two types of catheter ablation: **left atrial ablation** and **AV node ablation**. The type used depends on the kind of A-fib being treated. A-fib medications may still need to be taken after these procedures are done.

## Left Atrial Ablation

Left atrial ablation can help treat paroxysmal and persistent A-fib. It is used when medications and electrical cardioversion don't work. Left atrial ablation can greatly reduce or eliminate A-fib symptoms. A common type of left atrial ablation is called **pulmonary vein isolation (PVI)**.

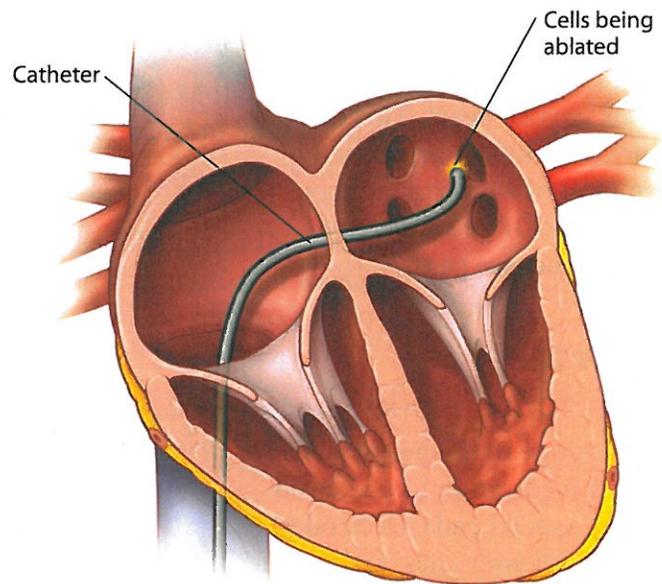
### How the Procedure Works

Left atrial ablation is done in the hospital. You're given medication to make you sleep. During the procedure, heat or cold is used to destroy the heart cells thought to create or carry the abnormal signals that cause A-fib. After the procedure, you'll likely stay in the hospital for one day so your heart rate can be monitored. You will need to take blood thinners for a few months after the procedure.

### Risks and Complications

Left atrial ablation has risks and possible complications. These are uncommon and include:

- Bleeding around the heart
- Stroke
- Damage to the pulmonary veins
- Damage to the esophagus



During left atrial ablation, a catheter is used to destroy certain cells in the left atrium. This stops the abnormal signals that cause A-fib.

### When to Call the Doctor

After this procedure, be sure to call your healthcare provider if you have any of the following:

- Fever of 100°F (37.7°C) or higher
- Persistent cough
- Trouble swallowing
- Shortness of breath
- Coughing up blood
- Symptoms of stroke (see page 16)

## AV Node Ablation

This procedure is used to treat all types of A-fib that can't be treated with medications or other techniques, such as left atrial ablation. Also called "ablate and pace," AV node ablation does not eliminate A-fib. However, it greatly reduces symptoms.

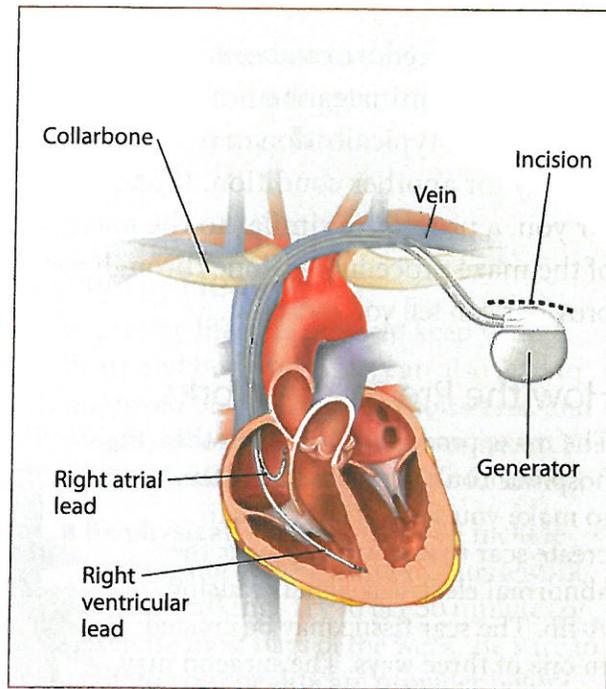
### How the Procedure Works

AV node ablation is done in the hospital. You're given medication to make you sleep. During this procedure, an electric current destroys the whole AV node. This keeps the node from receiving the abnormal signals that make the ventricles contract too quickly. But without the AV node, the ventricles now contract too slowly. So, a **pacemaker** is implanted to tell the ventricles to contract at a normal rate. A-fib remains in the atria, so stroke is still a risk. As a result, you will likely need to keep taking blood thinners.

### Risks and Complications

AV node ablation has small risks and possible complications. These include:

- Bleeding
- Infection at the incision site
- Puncture of the lung or heart muscle
- Dislodging of pacemaker lead



With AV node ablation, the AV node is destroyed and a pacemaker is placed in the chest. The pacemaker sends signals that replace the signals no longer sent by the AV node.

### When to Call the Doctor

After this procedure, be sure to call your healthcare provider if you have any of the following:

- Bleeding or signs of infection at the incision site, such as increasing redness, swelling, warmth, or drainage
- Fever of 100°F (37.7°C) or higher
- Pain around your pacemaker that gets worse, not better
- Chest pain or shortness of breath
- Frequent or constant hiccups
- Dizziness or fainting

## The Maze Procedure

The maze procedure can be used to treat all types of A-fib. It greatly reduces or eliminates the number of A-fib episodes. The maze procedure is typically done on people who are having open heart surgery for another condition. If open heart surgery is not planned for you, a procedure similar to the maze may be done. This variation of the maze procedure is done through a small incision. Your healthcare provider can tell you more.

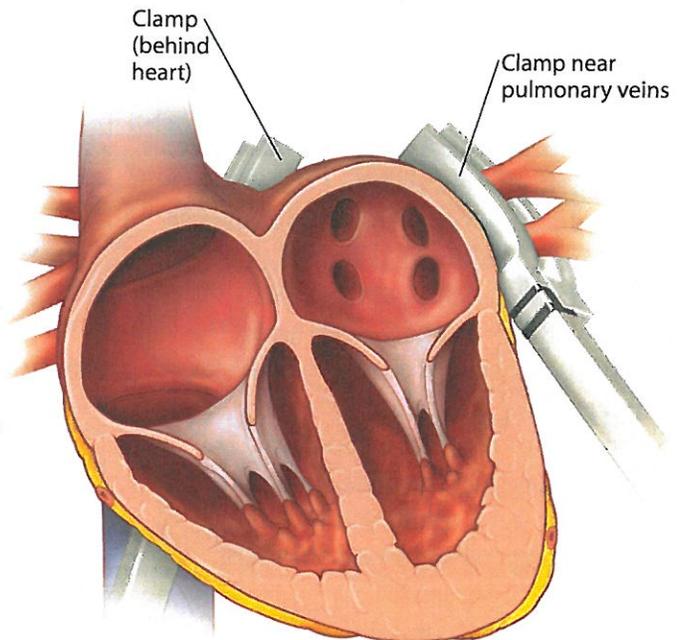
### How the Procedure Works

The maze procedure is done in the hospital. You're given medication to make you sleep. The goal is to create scar tissue, which blocks the abnormal electrical signals causing A-fib. The scar tissue may be created in one of three ways. The surgeon may place clamps on the heart near the pulmonary veins to deliver electrical energy to create the scar. Certain areas of tissue in the heart may be frozen (cryotherapy) to cause scarring. Or, microwave energy or ultrasound can be used to create the scar tissue. In addition, a small chamber called the left atrial appendage may be removed from the left atrium. Blood clots that cause strokes are often found here.

### Risks and Complications

The maze procedure has risks and possible complications. These include:

- Risks from open heart surgery (including excessive bleeding, lung infection, heart attack, stroke, and death)
- Damage to the SA node
- Damage to the esophagus
- Stroke
- Slowing the heart rate too much, requiring a pacemaker



During the maze procedure, clamps may be used to create scar tissue on the heart, blocking abnormal signals.

### When to Call the Doctor

After this procedure, be sure to call your healthcare provider if you have any of the following:

- Fever of 100°F (37.7°C) or higher
- Shortness of breath
- Dizziness or fainting
- Coughing up blood

# Living with Atrial Fibrillation

Treatment for A-fib can help improve your health. So be sure to follow your treatment plan. Also, avoid things that seem to trigger A-fib episodes. Take care of other health problems you may have. And make heart-healthy choices in your daily life.

## Avoiding Triggers

Certain things can cause an A-fib episode in some people. These are called triggers. Common triggers include alcohol, caffeine, and stress. Talk to your healthcare provider for ways to manage your triggers.

## Taking Care of Other Health Problems

Certain health problems can make A-fib worse, so it's important to take care of them. Health problems that should be carefully managed include:

- Heart disease, including heart failure
- High blood pressure
- Diabetes
- Overactive thyroid
- Lung disease
- Sleep problems
- Obesity

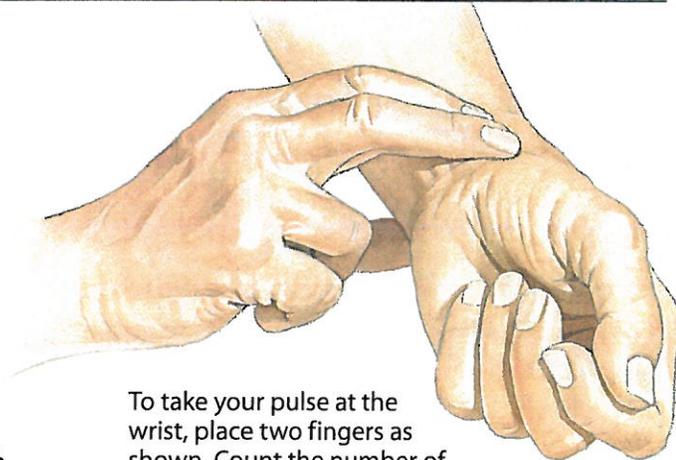
## Living Healthy

A healthy lifestyle can help keep your heart and body strong. It can also lead to improved blood pressure, cholesterol, and weight, all of which benefit your heart. For a heart-healthy lifestyle, try the following:

- **Be physically active.** This can include working out at the gym, doing housework, or just walking. Try to get 30 minutes of exercise most days of the week. Be sure to talk to your healthcare provider before starting any exercise plan.
- **Eat healthy.** Start by choosing healthier fats. For instance, try to eat 2 servings per week of fatty fish, such as salmon. Also, eat lots of fruits, vegetables, and whole grains. And reduce the amount of sodium (salt) in your diet.

## Taking Your Pulse

Taking your pulse (heart rate) can help you and your healthcare provider track how well your A-fib treatment is working. It can be done at the wrist or the neck. Take your pulse as often as your healthcare provider suggests. And be sure to take it during any suspected A-fib episodes. Recording your pulse in a log can be helpful. Include details about any A-fib episodes such as the date, duration, and maximum heart rate.



To take your pulse at the wrist, place two fingers as shown. Count the number of beats for 10 seconds. Multiply that number by 6 to get your pulse per minute.

## Staying Healthy

Don't let atrial fibrillation hold you back. Follow your treatment plan. Stay in touch with your healthcare provider. And make heart-healthy choices. These steps can help you manage your condition so you can feel good and live a normal, healthier life.

### Know the Symptoms of Stroke

Part of keeping healthy when you have A-fib is knowing how to recognize a stroke.

**Call 911 or emergency services immediately if you have any of the following:**

- Weakness, numbness, tingling, or loss of feeling in your face, arm, or leg
- Trouble seeing; double vision
- Trouble speaking or understanding others
- Loss of balance, a feeling of spinning, or blackouts
- Sudden, severe headache

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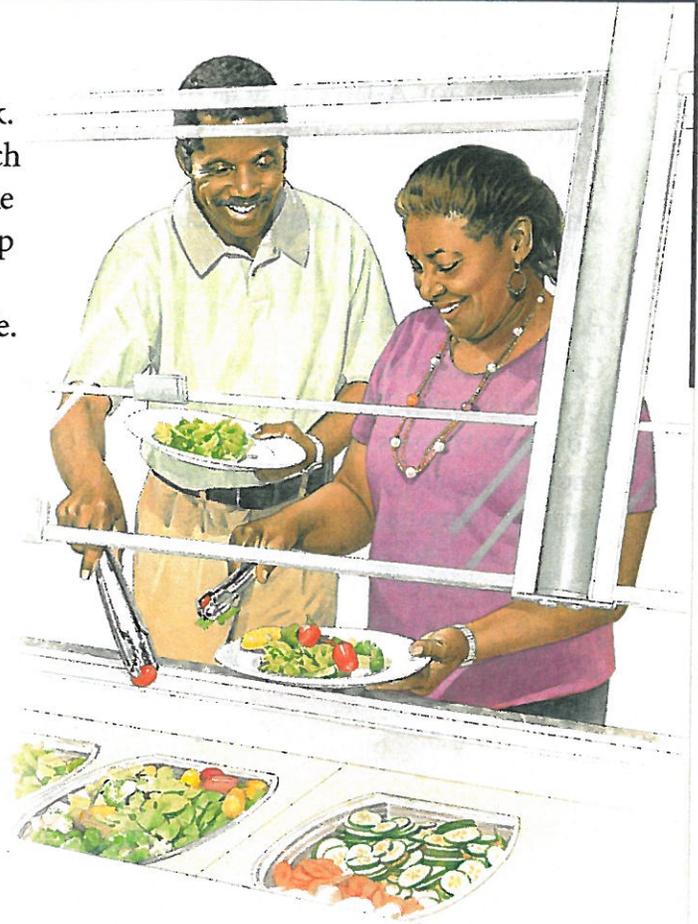
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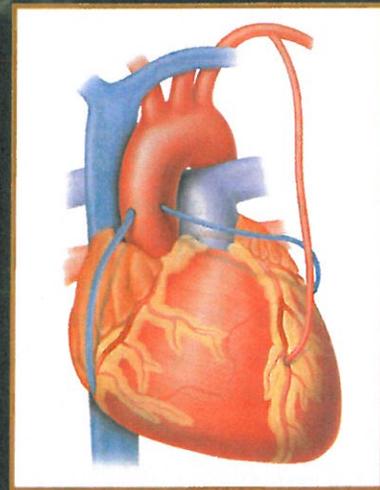
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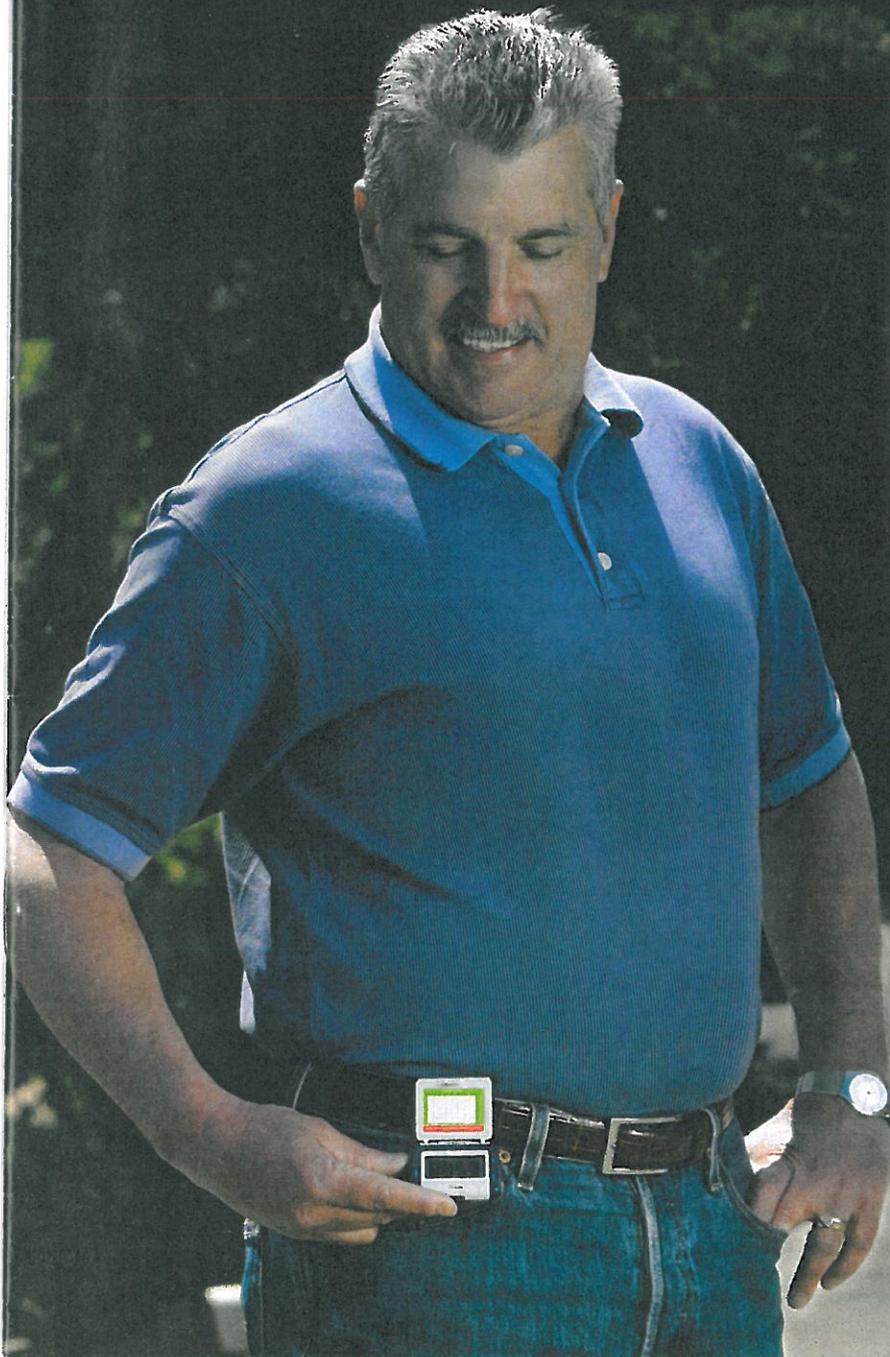
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# Understanding Coronary Artery Bypass Surgery



- **Understanding Coronary Artery Disease (CAD)**
- **Before, During, and After Surgery**
- **Making Changes for a Healthier Heart**



## Surgical Treatment for CAD

Coronary artery disease (CAD) is a serious health problem. The arteries that carry blood to your heart become blocked. Left untreated, this can lead to a heart attack. **Coronary artery bypass surgery** (also called CABG) is a treatment that can help. This surgery uses a **graft** (blood vessel from another part of your body) to make a new pathway (bypass) around a blockage. Read this booklet to learn how bypass surgery will put you on the road to a healthier future.

## Risk Factors for CAD

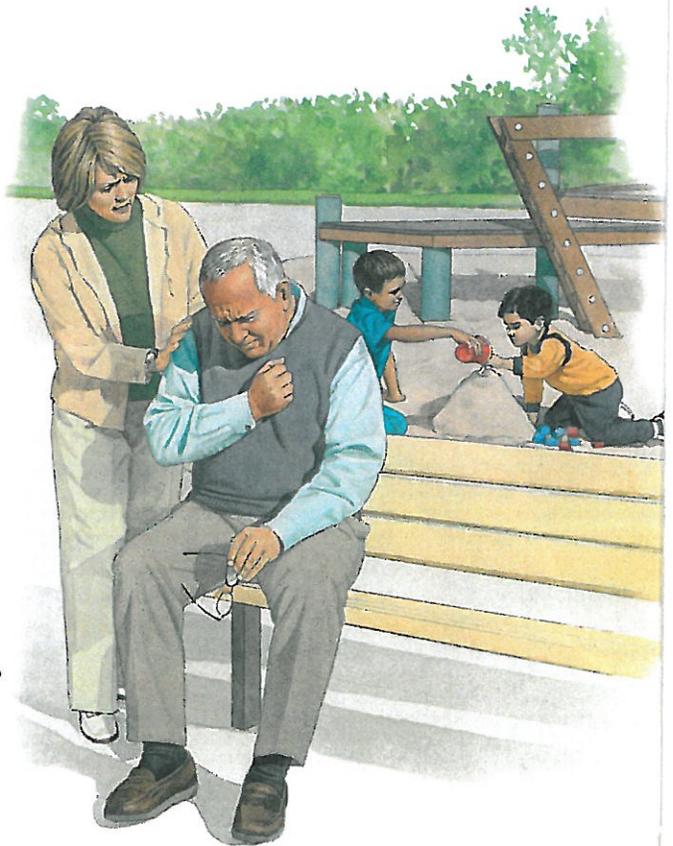
Certain **risk factors** increase your chances of developing CAD. For instance, high blood pressure, high cholesterol, and diabetes all make CAD more likely. Smoking, being overweight, and eating unhealthy foods can increase your risk even more. Risks like these can be controlled to help make your heart healthier. Other risk factors are things you can't change, such as age and a family history of heart problems.

## Symptoms of CAD

When you have CAD, your heart muscle doesn't get enough blood and oxygen. This causes symptoms such as:

- **Angina** (a feeling of pain, pressure, aching, tingling, or burning in the chest, back, neck, throat, jaw, arms, or shoulders)
- Tiredness or lack of energy
- Shortness of breath
- Dizziness
- Nausea

Often, women have different symptoms than men. In some cases, especially in people with diabetes, there may be no obvious symptoms.



Angina is a sign that you are at risk of having a heart attack.

This booklet is not intended as a substitute for professional medical care. Only your doctor can diagnose and treat a medical problem.

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## Why You Need Surgery

Your doctor has determined that bypass surgery is the best treatment for your CAD. Bypass surgery doesn't cure CAD. Still, it's a procedure that could save your life. Without treatment, you could have a heart attack. This can lead to other major problems, even death. Bypass surgery is a serious procedure. It may take you several months to fully recover. But the benefits far outweigh the risks. Bypass surgery will improve blood flow to your heart. This reduces your chances of a heart attack. And once you've had surgery, you can focus on managing your risk factors for CAD. This will decrease your chances of developing new blockages.



Based on the extent of your CAD, your doctor has recommended bypass surgery.

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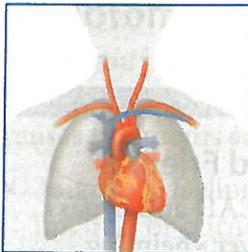
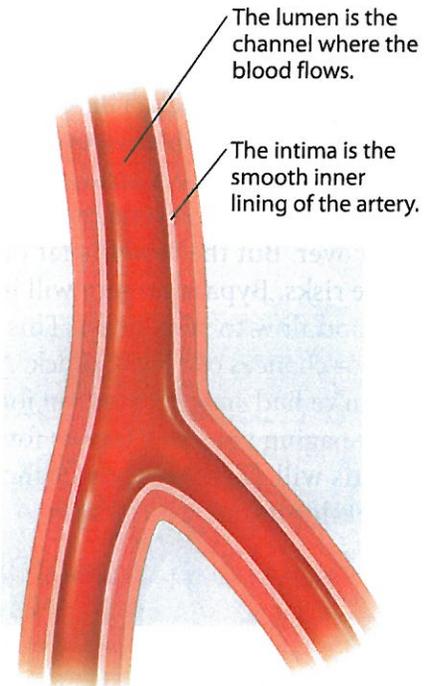
Learning about CAD and bypass surgery can be overwhelming. Going through bypass surgery can also be very emotional—for the patient, as well as for family and friends. This booklet is for your loved one, but it's also for you. It will help answer many of your questions about what surgery will be like. The information in this booklet will also show you ways to help and support your loved one before and after surgery.

# How Coronary Artery Disease Develops

The heart is a muscle about the size of your fist. It pumps blood throughout the body. Like other muscles, the heart needs a steady supply of oxygen to function. Blood carries oxygen to the heart and the rest of the body through blood vessels called arteries. In the heart, the **coronary arteries** supply blood and oxygen to the heart muscle. If the muscle doesn't get enough oxygen, angina or a heart attack can result.

## Healthy Coronary Arteries

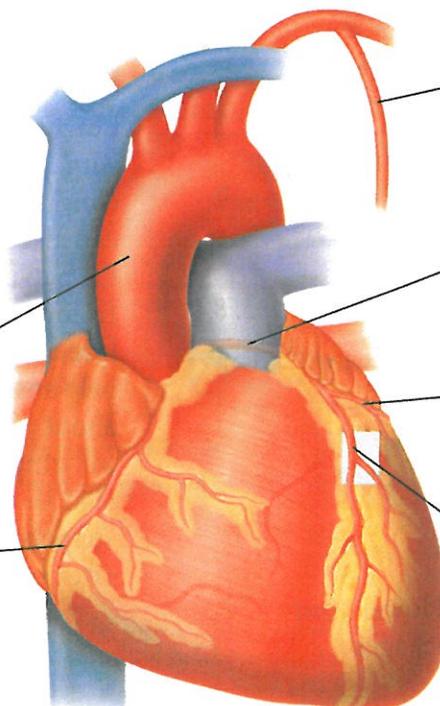
Coronary arteries wrap around the surface of the heart. They supply the heart muscle with oxygen-rich blood. The amount of oxygen the heart needs depends on how hard it's working. For instance, exercise makes the heart beat faster. This increases the muscle's need for oxygen. Healthy arteries can easily meet this need. They have smooth, flexible walls that accommodate changes in blood flow.



The heart is located between the lungs, near the center of the chest.

The **aorta** carries blood from the heart to the rest of the body. The coronary arteries branch off the aorta.

The **right coronary artery** supplies blood to the right side and bottom of the heart.



The **internal thoracic (mammary) artery** supplies blood to the chest wall. It may be used as a graft during surgery.

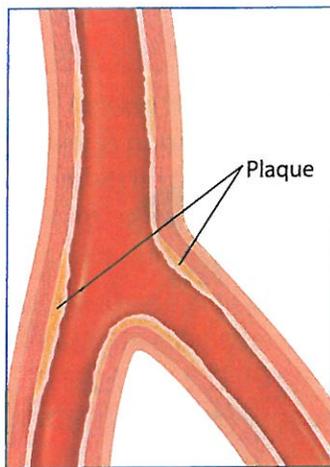
The **left main coronary artery** divides into two branches, described below.

The **circumflex coronary artery** supplies blood to the back, left side, and bottom of the heart.

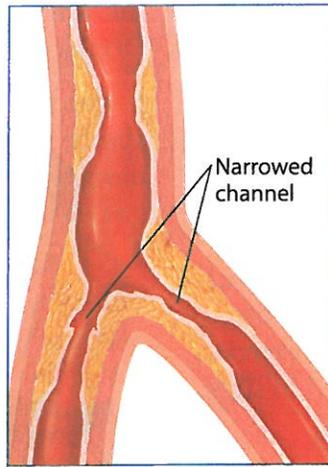
The **left anterior descending coronary artery** supplies blood to the front and left side of the heart.

## Coronary Artery Disease (CAD)

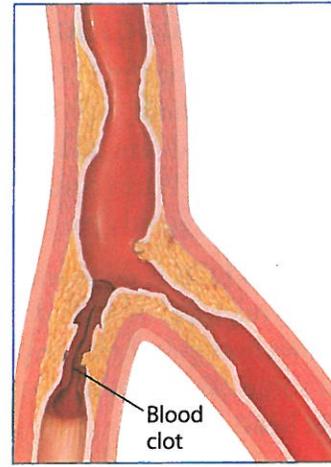
CAD starts when the inner lining of a coronary artery is damaged. This is due to risk factors, such as smoking or high cholesterol. **Plaque** (a fatty material composed of cholesterol and other particles) then builds up within the artery wall. This buildup (called atherosclerosis) narrows the channel inside the artery. It also makes artery walls less able to expand. At times when the heart needs more oxygen, not enough oxygen-rich blood can get through to meet the need. This can lead to angina.



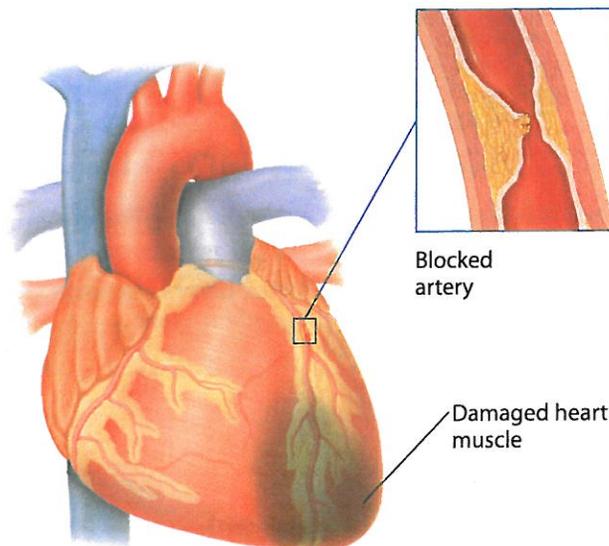
**Plaque forms between layers of the artery wall** when the inner lining of the artery is damaged.



**Plaque narrows the channel** where blood flows. The artery can't meet increased demands for blood.



**Plaque may rupture**, narrowing the artery even more. A blood clot may cut off blood flow in the narrowed artery.



## Heart Attack

A heart attack (myocardial infarction) occurs when a coronary artery is blocked by plaque or a blood clot. When this happens, the heart muscle beyond the blockage doesn't receive enough oxygen. If blood flow isn't restored quickly, that part of the heart muscle dies. This damage cannot be reversed. Though many people survive heart attacks, they can be fatal.

## Your Evaluation

By evaluating your heart, your doctor learns the extent of your CAD. To start, you're asked about your symptoms and health history. Then you have a physical exam and blood tests. These help identify other health problems that may be contributing to your CAD, such as high blood pressure, high cholesterol, or diabetes. Based on what is found during this part of the evaluation, some of the following tests are done. These help determine if bypass surgery is the right treatment for you.

### Electrocardiogram

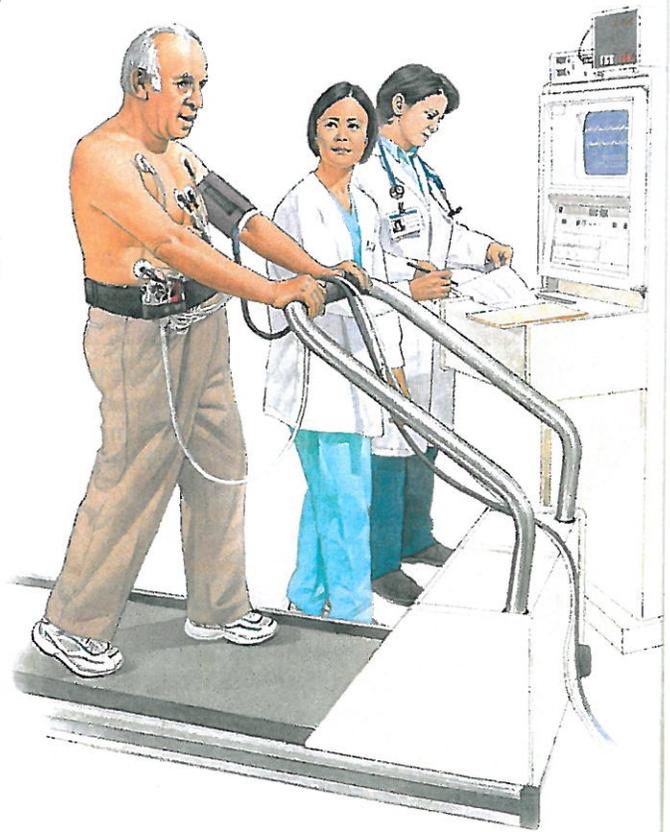
An electrocardiogram (ECG or EKG) records the way electrical signals travel through your heart. Small pads are placed on your chest, arms, and legs. Wires connect the pads to a machine that records your heart's signals.

- A **stress ECG** is done while you exercise on a treadmill or stationary bike. This shows how your heart responds to exercise. In some cases, medication is used to stress the heart instead.
- A **resting ECG** is done while you sit or lie down. This can show if your heart is receiving too little oxygen. It also shows whether your heart has already been damaged by a heart attack.

### Imaging Tests

These tests may be done during stress or while you're resting. They show how well your heart pumps. They also show if arteries can meet an increased demand for blood.

- An **echocardiogram** uses sound waves to show the structure and movement of the heart.
- **Nuclear imaging** is done by injecting a small amount of radioactive material into a vein. The heart absorbs this material, which allows a scanning camera to take pictures of the heart.

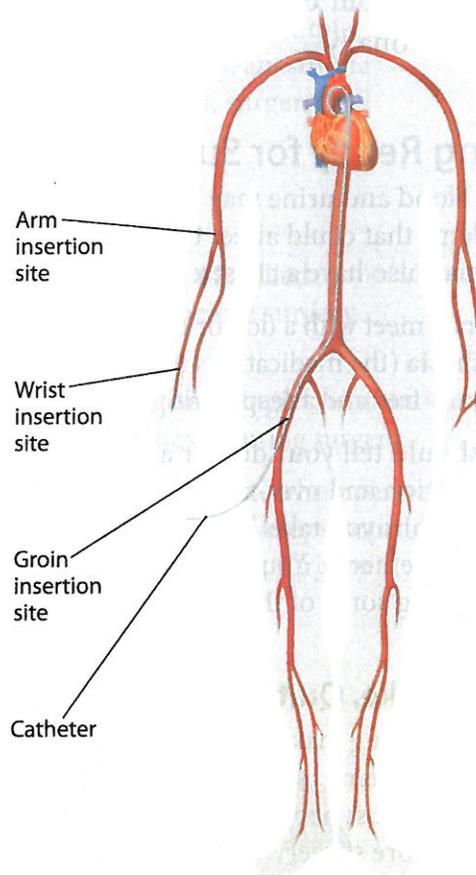


A stress ECG shows your heart's response to an increased demand for blood.

## Cardiac Catheterization

This procedure can pinpoint where coronary arteries are narrowed, damaged, or blocked. It helps your doctor decide on your treatment. During cardiac catheterization, a **catheter** (thin, flexible tube) is inserted into the coronary arteries. Then **angiograms** (x-rays) are taken of the arteries. You'll be awake during the procedure, but you'll receive medication to help you relax. During the procedure:

- The skin in the area of the insertion site is numbed. An introducing sheath (tube) is inserted into a site in the groin, arm, or wrist. The sheath remains in place during the entire procedure.
- A catheter is inserted into the sheath and threaded through the arteries. The catheter is guided to the heart with the help of x-ray monitors.
- X-ray dye (also called contrast) is injected through the catheter. This allows the coronary arteries to show up on angiograms. You may feel a warm flush as the dye is injected.
- Angiograms are taken. These show where blockages are.



Possible catheter insertion sites

## Deciding On Your Treatment

In some cases, blockages can be treated during cardiac catheterization with procedures called angioplasty and stenting. But based on the size, number, and location of the blockages, your doctors may decide that bypass surgery is the best treatment. You may need surgery just after your catheterization. Or surgery may be scheduled for a later date.

## Your Surgical Experience

Surgery may take place very soon after your evaluation. If time permits, you will meet with your doctor a few days before. At this visit, you'll be told how to prepare. It's okay to be nervous. Don't be afraid to share your feelings with your doctor, family, and friends. Doing so can help you get ready emotionally.

### Getting Ready for Surgery

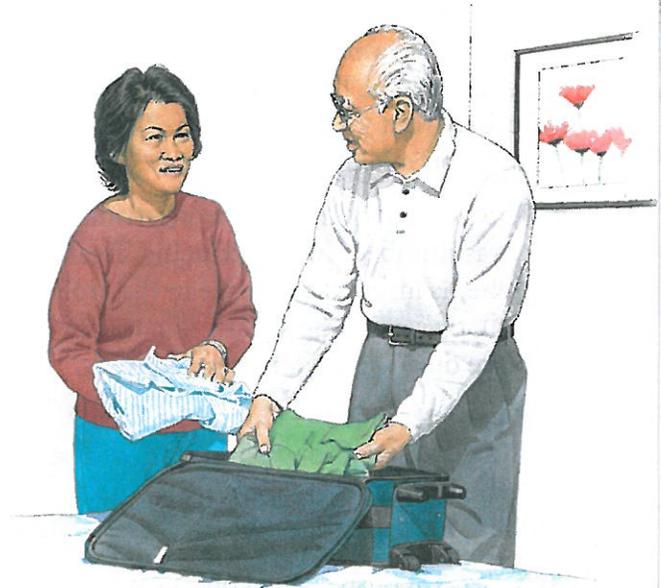
- Your blood and urine may be tested for problems that could affect the surgery. You may also have a chest x-ray.
- You may meet with a doctor to discuss **anesthesia** (the medications that will keep you pain-free and asleep during surgery).
- You should tell your doctor about all prescription and over-the-counter medications you take. This includes herbs and supplements. You may be asked to stop taking some of these.

### If You Smoke, Quit!

Quitting smoking makes you less likely to have lung problems as you recover from surgery. For most people, quitting even a few days before surgery can be helpful.

### For Family and Friends

- Encourage your loved one to talk about his or her feelings and fears. This can help both of you cope.
- Join your loved one at doctor's appointments. Feel free to ask any questions you have.



You won't need your suitcase right away. Ask someone to bring it to the hospital for you.

### Just Before Surgery

Here are some ways to prepare at home:

- Pack a small suitcase with a bathrobe and toiletries, such as a toothbrush. Don't bring any valuables or jewelry (not even your wedding ring).
- Try to get a full night's sleep the night before surgery.
- Don't eat or drink anything after the midnight before surgery. This includes water.
- Shower the night before and the morning of surgery. You may be told to use a special antiseptic soap.

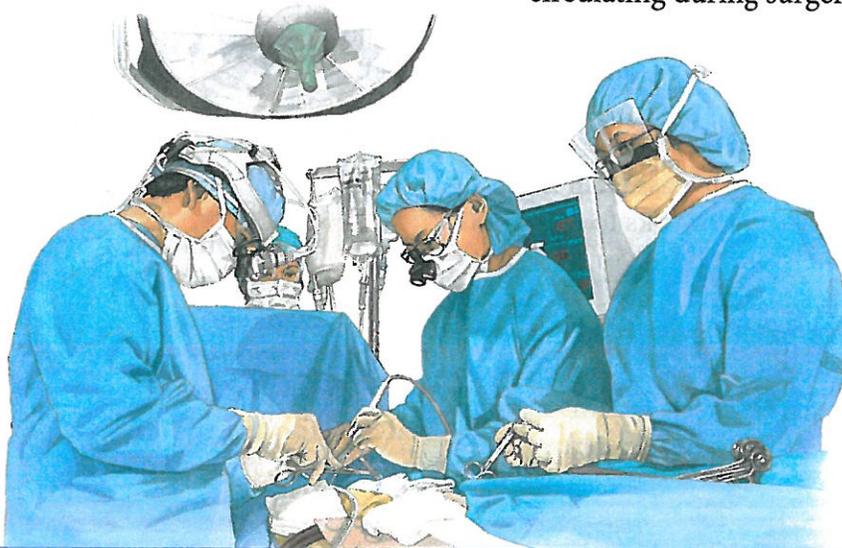
## On the Day of Surgery

If needed, the hair on your chest or other incision sites will be removed. You'll receive medication through an IV. This will make you groggy and help you relax. Lines will be connected to your finger, wrist, arm, and neck. These are attached to machines that monitor your oxygen levels, heart rate, blood pressure, and pressures in your veins. Just before surgery, anesthesia will be given to prevent pain and keep you asleep. Rest assured, surgery will not start until the anesthesia has taken effect.

## Your Bypass Team

You can feel secure that your surgery is being done by a team of skilled professionals. You'll be introduced to members of this team before surgery starts. The team may include the following people:

- **The heart surgeon and assistants**, who prepare the bypass graft and perform the bypass.
- **Nurses**, who help with the surgery.
- **The anesthesiologist**, who monitors the anesthesia during surgery.
- **The perfusionist**, who operates the machine that keeps your blood circulating during surgery.



## For Family and Friends

- Surgery will take at least 4 to 6 hours. You may choose to wait at the hospital. If so, bring something to do. You can also leave and come back when the surgery is over. Leave a phone number where you can be reached.
- You will most likely be able to see your loved one after surgery that same day. Be prepared to go home at night.

## How Bypass Surgery Is Done

During bypass surgery, blockages are not removed. Rather, a new pathway is created around the blocked part of a coronary artery. First, a healthy blood vessel is taken from another part of the body. This is the bypass graft. The graft is attached to the coronary artery beyond the blockage. This way, blood flows through the graft and bypasses the blocked part of the artery.

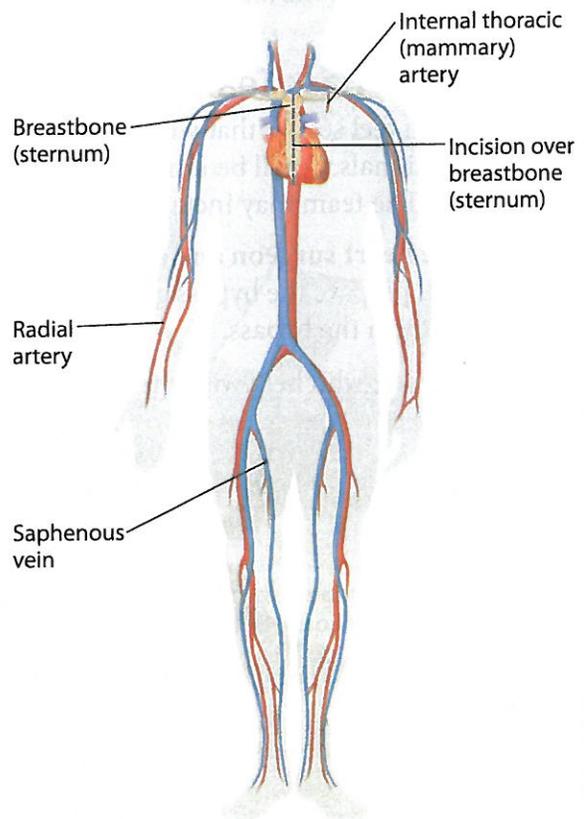
### Preparing the Bypass Graft

The bypass graft is taken from another part of your body. This usually doesn't affect blood flow in that body part. If you have more than one blockage, more than one graft may be needed. One or more of these blood vessels will be used:

- The **saphenous vein**, which is located in the leg.
- The **radial artery**, which is located in the arm.
- The **internal thoracic (mammary) artery**, which is located in the chest wall.

### Reaching the Heart

While one member of the bypass team is getting the graft, another member works to reach your heart. First, an incision is made in the chest. Then the breastbone (sternum) is divided. The breastbone is held open throughout surgery. This puts pressure on the nerves of the chest. You may have soreness and muscle spasms in your chest, shoulders, and back during recovery.



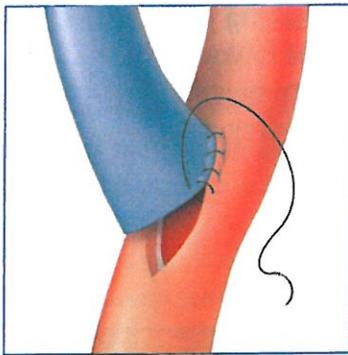
### Risks and Complications

Your doctor will explain the possible risks of bypass surgery. These may include:

- Excessive bleeding
- Infection of the incision sites
- Pneumonia (lung infection)
- Fast or irregular heartbeat
- Nerve injury or muscle spasms
- Breathing problems
- Memory problems or confusion
- Heart attack, stroke, or death

## Using the Heart-Lung Machine

In some cases, a machine does the work of your heart and lungs during surgery. Blood is circulated through this heart-lung machine. The machine supplies the blood with oxygen and pumps it back through the body. This is known as an “on-pump” procedure. In these cases, the heart may be stopped temporarily before the graft is attached. Your own heart and lungs take over after the bypass is completed. In other cases, the heart-lung machine is not used and the heart is not stopped. This is known as an “off-pump” or “beating heart” procedure.



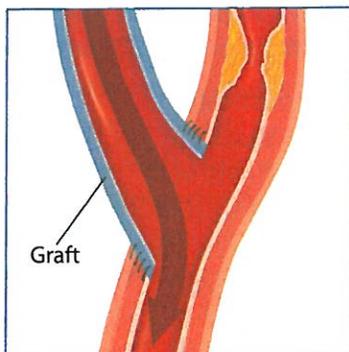
## Attaching the Graft

A small opening is made in the coronary artery, below the blockage.

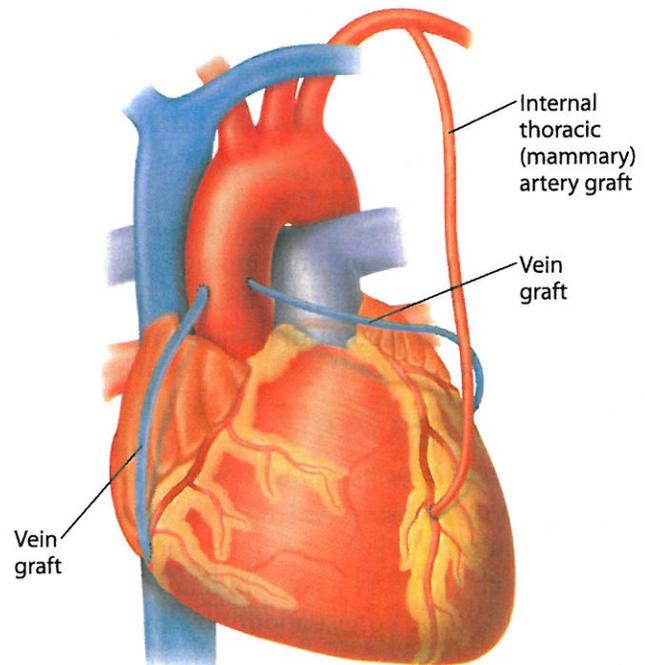
- **If a saphenous vein or radial artery is used**, one end of the graft is sewn onto this opening. The other end is sewn onto the aorta.
- **If the internal thoracic (mammary) artery is used**, one end of the graft is sewn onto this opening. The other end is already attached to a branch of the aorta.

## Finishing Up

Once the graft has been attached, blood will start flowing through this new pathway to bypass the blockage. If you have multiple blockages, more than one bypass may be done. Then your breastbone is rejoined with wires. These wires will stay in your chest permanently. The incision is closed, and you are taken to the intensive care unit to begin your recovery.



Once the bypass graft has been attached, blood can flow around the blockage.



## After Your Surgery

You will be taken to the ICU (intensive care unit). When you wake up, you may be thirsty, groggy, and cold. These sensations are common and won't last long. Dedicated nurses will make sure you have everything you need. When your condition is stable, you will be moved to another part of the hospital. This may happen the same day as surgery, or a day or more later.

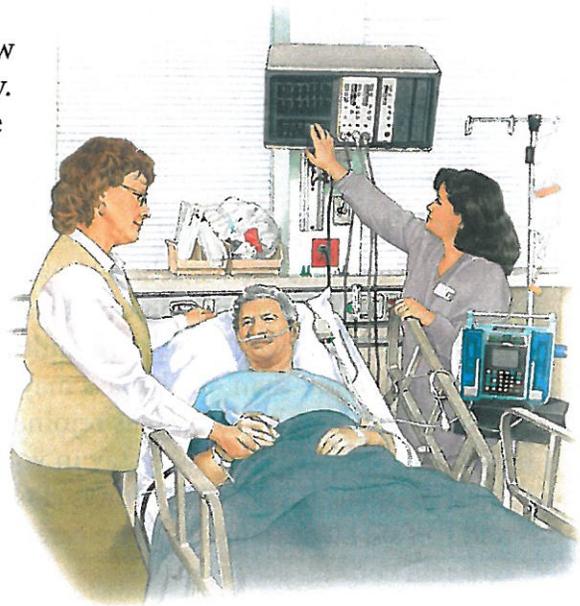
### To Help You Breathe

At first, a tube will help you breathe. It is inserted through your mouth and into your throat. This is normal. You won't be able to talk with the breathing tube in. Nurses will ask simple questions so you can respond by nodding or shaking your head. The tube may make your throat sore. There may also be a tube in your nose or mouth, which keeps your stomach empty. As soon as you can breathe on your own, these tubes will be removed. Then you'll likely receive oxygen through a mask or small prongs in your nose.

### To Monitor Your Condition

You'll be connected to tubes and machines that allow your nurses to monitor your health and recovery. The connections will be removed as you become stable. You may have:

- A line in your wrist or neck to monitor blood pressure or other pressures in your heart.
- An IV to provide medications and fluids.
- Drainage tubes to drain fluid from your chest.
- A catheter to drain urine.
- An intraaortic balloon pump to take over some of the heart's pumping function (if needed). This lets the heart relax and recover. You will likely be sedated until this is removed.



### To Manage Pain

You'll receive medication to control pain. You may be given IV or oral medication. Or you may have a PCA (patient controlled analgesia) machine. This machine lets you push a button to give yourself a measured dose of pain medication. Research shows that people recover faster after surgery if pain is kept under control. So, be honest about how much pain you feel. And don't be afraid to ask for pain medication when you need it. Tell your nurse if the medications don't reduce pain or if you suddenly feel worse.

## Preventing Lung Problems

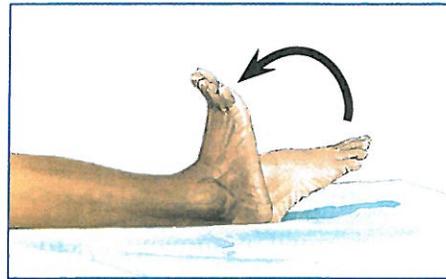
After the breathing tube has been removed, a respiratory therapist or nurse will help you with deep breathing and coughing exercises. These help prevent pneumonia. Your healing breastbone incision may make deep breathing and coughing painful. Still, it's very important to do the exercises. You'll be taught how to do them in a way that lessens the pain.



You may use an incentive spirometer to clear your lungs.

## Reducing Swelling

Your legs may be swollen after surgery, especially if grafts were taken from them. Raising the foot of your bed can help reduce swelling. Your nurse will help with this. You may also be taught to do exercises in bed, such as the ankle exercise described below.



Do ankle exercises as often as recommended.

## Ankle Exercise

- Start with your toes pointed. Flex your foot at the ankle and count to 5. Then relax.
- Repeat 10 times with each foot.

## Getting Out of Bed

A nurse or physical therapist will help you get out of bed. This will happen early in your recovery, maybe even before you leave the ICU. Moving around improves circulation and helps prevent blood clots and pneumonia. You may sit on the edge of the bed with your legs dangling over, or have help getting into a chair. When you're well enough, a staff member will help you walk. Keep in mind that being active, even this soon after surgery, helps move your recovery along.

## For Family and Friends

- Be prepared for your loved one to be pale, puffy, and attached to many tubes. This is normal. He or she may also be groggy or asleep when you first visit.
- Limit your visits to the ICU so your loved one can rest and recover. Although every ICU has a different policy, be prepared to stay only about 10 minutes at a time.
- Your loved one will probably not need his or her suitcase until after leaving the ICU. A member of the healthcare team will let you know when to bring it.

## Getting Ready to Go Home

When you no longer need constant care, you will be moved from the ICU to another part of the hospital. At this point, you'll start playing a more active role in your recovery. Every patient recovers from bypass surgery at a different rate. The length of your hospital stay depends on how well you're doing, your overall health, and your situation at home. Many people stay in the hospital for 3 to 7 days after bypass surgery, but it's not uncommon to stay longer.

### Protecting Your Breastbone

Your breastbone was divided to reach the heart during surgery. The bone will take 6 to 8 weeks to heal. While in the hospital and then at home, you need to take special care of your breastbone. This will reduce pain and aid healing. Avoid motions that strain your arms or chest. This means no pushing, pulling, or lifting heavy objects. Also, avoid reaching behind you or high above your head. You'll be shown ways to move that protect the breastbone, such as the method below for standing.

### Standing Up

When you get out of a chair, it's okay to use your arms for balance. But don't push them against the arms of the chair. To stand:

- Scoot to the very front edge of the chair.
- Rock yourself onto the balls of your feet. Slowly rise to a standing position.
- Use the same method to get out of bed. Don't push your arms against the mattress.



At first, a member of your healthcare team will help you stand up.

### Preparing to Leave the Hospital

Before you leave the hospital, your doctor or nurse will talk to you about the next steps of your recovery. If new medications have been prescribed, you will be told when and how to take them. Make sure you know when your next doctor's appointment will be. You may also talk to a social worker or caseworker about whether you'll need help at home. If needed, arrangements will be made for you to stay at a skilled nursing facility or other medical center as you recover.

## Recovering at Home

You'll receive discharge instructions when you leave the hospital. These tell you how to deal with certain situations as you recover. Do as much as you comfortably can. Staying active will help speed recovery. To protect your healing breastbone, though, you will likely need some help from others.

### Getting Back Into Your Routine

Follow your doctor's guidelines. Here are some general time frames:

- **Showering.** Unless you're told otherwise, you can shower once you get home. Don't use very hot water. (This can make you dizzy.) Have someone nearby in case you need help. Don't take a tub bath until your doctor says it's okay.
- **Daily activities.** Resume activities as you feel comfortable doing so. Within a few days you can return to light activities, such as cooking. Don't do anything strenuous, such as mowing the lawn or vacuuming, for at least 6 weeks.
- **Driving.** Don't drive until your doctor says you can. This will be around 3 to 6 weeks after surgery. This is important for many reasons. Soreness or stiffness may make driving uncomfortable. And you shouldn't drive when you're taking pain medication.
- **Work.** Depending on your job, you may return to work 3 to 12 weeks after surgery.
- **Sexual intercourse.** You may be told to avoid sex for 4 to 6 weeks. When you do have sex, use positions that don't strain your breastbone. Talk to your doctor if you're concerned.

### Caring for Your Incisions

Your incisions may be bruised, itchy, numb, and sore. After a shower, pat them dry (don't rub). Don't use lotion or powder. Be sure to check the incisions every day. This way you'll see any signs of problems early (see page 16).



To protect your breastbone, ask family members for help reaching high shelves.

### For Family and Friends

- Let your loved one be independent. Make yourself available, but step back and let your loved one do what he or she is able to do. Try not to be overprotective.
- You can help by picking up prescriptions and driving your loved one to appointments.

## Life After Bypass Surgery

Bypass surgery has reduced your risk of a heart attack. But remember that surgery is a treatment, not a cure. You must now maintain an active role in your care to help ensure a healthy future. Pay attention to how you're feeling, physically and emotionally. See your healthcare provider as often as recommended. And get ready to manage CAD by making a few changes to your lifestyle.

### Visits with Your Healthcare Team

As you heal, you will have follow-up visits with your healthcare team. Between visits, don't hesitate to call your doctor's office if you have any questions. Or you can write down your questions and bring the list to your next visit. You'll likely have:

- A visit with your surgeon, so your incisions can be checked.
- A visit with your heart doctor, so your medications can be adjusted.
- Continued visits with your heart doctor or primary care doctor, as often as recommended.



Keep in touch with your healthcare team as you heal.

### As Your Breastbone Heals

Don't be surprised if you feel sharp pains in your chest as your breastbone heals. You may also notice that changes in the weather make your incision hurt. These pains feel different from angina and are most likely not signs of a heart attack. If you have questions about what you're feeling, or if your pain isn't managed by medication, call your healthcare provider.

### When to Call Your Healthcare Provider

These are warning signs of infection and other problems:

- Fever over 100.4°F (38°C)
- Unexplained chills or sweating
- Sudden weight gain (5 pounds or more in 1 week)
- Increasing pain that isn't controlled with medication
- Swelling, redness, oozing, or cloudy discharge at the incision sites
- Unexplained bruising or bleeding
- Continued clicking sounds in your breastbone
- Symptoms of angina, like those you felt before surgery (call your doctor or 911)

## Understanding Your Feelings

It's common to feel down or depressed after bypass surgery. The good news is, you don't have to "just live with" these feelings. Help is available. Coping with your feelings may actually help you recover more quickly and improve your overall health. Here are some things you can do:

- Try not to withdraw from family and friends. Remember that you're not alone. Staying involved and being social can help raise your spirits.
- Talk about your feelings. Also, think about joining a support group. It may be easier to talk to people who know firsthand what you're going through.
- Tell your healthcare provider how you feel. Treatment, such as counseling and medication, may help.
- Keep in mind that forgetfulness and confusion can be side effects of bypass surgery. These can be frustrating. Don't be afraid to ask for help when you need it.



## Managing CAD

Surgery has lowered your risk of a heart attack—for now. You need to understand that bypass surgery does not cure CAD. Although blood flow to the heart will be improved, new blockages could still form. You need to take steps to prevent this. By committing yourself to managing your risk factors for CAD, you can help keep new blockages from forming. This will lower your chances of needing another bypass surgery. Read the rest of this booklet to learn what you can do.

### For Family and Friends

- Encourage your loved one to talk about how he or she is feeling. Try to spend time together, doing things you both enjoy.
- Coping may be hard for you, too. You may want to join your loved one for a support group or counseling. There may even be support groups for family and friends of CAD patients in your area. Ask your loved one's healthcare provider for resources that may help.

# Taking Your Medications

From now on, you will be taking medication to keep your CAD under control. You may also take medications for related health problems. Your medications must be taken as prescribed, or they won't work properly. In most cases, this means they're taken every day. This may be hard at first, but you'll get used to it. Some of the tips below can help.

## Heart Medications

Some of these medications may be prescribed after your bypass surgery:

- **Antiplatelet medications** (such as aspirin) help prevent blood clots. They also reduce your risk of a heart attack.
- **Beta-blockers** reduce the heart rate and the force of the heartbeat. They also lower blood pressure.
- **ACE inhibitors** lower blood pressure and decrease strain on the heart.
- **Lipid-lowering medications** reduce the amount of LDL ("bad") cholesterol and other fats in the blood. Some medications also improve levels of HDL ("good") cholesterol.
- **Nitroglycerin** can stop an angina attack. Your healthcare provider will instruct you on when and how to use it.

## Other Medications

Depending on your risk factors, you may also take medications for related conditions:

- If you have high blood pressure, you may take medications such as diuretics and vasodilators. These lower blood pressure, which helps control CAD.
- If you have diabetes, pills or insulin injections can keep blood sugar under control. This reduces the risk of diabetes complications, including CAD.



## Tips for Taking Medications

Taking your medication as prescribed can help you feel better and stay healthy. To get the most benefit:

- Set up a routine. For example, take your medication with the same meal each day, or before you go to bed.
- Give yourself plenty of time to refill a prescription before it runs out. When traveling, be sure you have enough medication to last until you get home.
- Keep a list of all your medications and their dosages. Show this list to any doctor or dentist who treats you. Also show it to your pharmacist before buying any prescription or over-the-counter medication.

## Cardiac Rehabilitation

After your surgery, you'll likely be involved in a cardiac rehabilitation (rehab) program. This program covers many areas to help keep your heart as healthy as possible. You'll work with a team of specialists. These may include doctors, nurses, exercise specialists, dietitians, and counselors. Cardiac rehab can help you get back into your normal routine after surgery. It can reduce your risk of future heart problems. And it can give you tools to improve your overall health for the rest of your life.

### Program Components

A cardiac rehab program can take place in a hospital, a clinic, or a doctor's office. The program includes:

- **Exercise.** You'll learn how to exercise safely. Your program will include exercises to increase fitness, endurance, and strength.
- **Nutrition education.** You'll work with a dietitian to learn the best ways to eat for heart health. You'll also learn ways to use this knowledge when you shop, cook, and eat out.
- **Assistance with managing risk factors.** You'll learn about controlling related conditions such as high blood pressure, high cholesterol, and diabetes.
- **Counseling.** You'll get help dealing with the emotional aspects of CAD and treatment. This may include help with depression and anxiety. It may also include practical advice and support for quitting smoking, losing weight, being physically active, and continuing your sex life.
- **Family education.** Your family can learn with you. That way, they can help you to continue using your new skills and knowledge after you finish the program.



## Exercise for You and Your Heart

Thanks to bypass surgery, your heart has been given a second chance. Now, it needs exercise to get back into shape. Walking is the best way to do this. You don't need any fancy equipment to walk. You don't even need good weather—you can walk indoors, such as at a shopping mall. The information below can help you get started.

### Getting Started

These guidelines will help you get the most out of walking:

- Set realistic goals. Start by walking 5 to 10 minutes a day. Work your way up to 30 minutes a day, most days of the week.
- Wear sturdy shoes with padded soles and arch support.
- At first, walk with someone so you'll have help if you need it. Walking may be more enjoyable when you have someone to talk to!
- Walk on fairly level ground. Avoid big hills. (Small hills are okay.)
- Don't walk too fast. If you're short of breath or can't carry on a conversation, you're pushing yourself too hard.

### How to Walk for Fitness

Start out by walking normally for about 5 minutes. This increases your heart rate slowly. Then walk briskly, taking quick, full strides. Swing your arms easily and take deep breaths. Finally, walk more slowly for about 5 minutes. This safely brings your heartbeat back to its normal rate. You should also stretch before and after your brisk walk. Ask your healthcare provider about stretches that are safe for you.



## Heart-Healthy Eating

Maintaining a heart-healthy diet can improve cholesterol levels and blood pressure. Eating well can also help you lose weight and manage diabetes. You don't have to give up your favorite foods entirely. But you may need to eat smaller portions of some foods, or to save those foods for special occasions.



### Things You Can Do

Following a heart-healthy diet means eating less fat, less salt, and more fresh fruits and vegetables. Try these tips:

- Read food labels when you shop. Talk to your healthcare provider about what you should be looking for.
- Eat fresh or plain frozen vegetables. These have much less salt than canned vegetables. If you use canned vegetables, rinse them well.
- Select lean cuts of meat. Trim off all the fat you can see. Remove and discard the skin from chicken and turkey before eating.
- Broil, bake, steam, or microwave foods instead of frying them.
- Season your food with herbs, lemon juice, flavored vinegar, or salt-free spice mixes, instead of using margarine, butter, or salt. Take the saltshaker off the table.
- Avoid cream, cheese, or butter sauces, which add fat and cholesterol.
- If you're dining out, ask your server for heart-healthy suggestions.

### If You Need to Lose Weight

Your doctor may tell you to lose weight. This helps keep your heart healthy. It can also lower your chances of developing certain risk factors. The keys to losing weight are eating well and exercising. Remember this:

**Eating fewer calories + being more active = losing weight**

## Controlling Risk Factors

To keep CAD under control, you must control as many risk factors as you can. Quitting smoking is one of the most important things you can do. Managing other problems, such as high blood pressure, cholesterol, diabetes, and stress, can also help. Work with your healthcare provider to identify your risk factors and to get them under control.

### Quitting Smoking

Smoking damages the lining of the blood vessels and raises blood pressure. If you smoke, quitting now could save your life. Here are some tips:

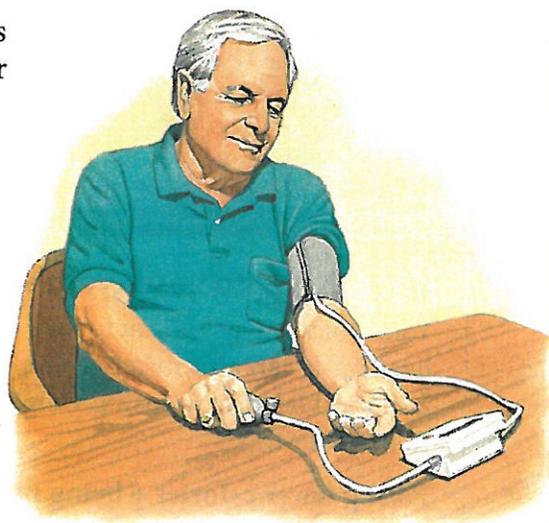
- Talk to your doctor about medications or other products that may help, such as nicotine patches or gum.
- Make a list of things that make you want to smoke. Plan ahead how you can avoid or deal with these “triggers.”
- If you don’t succeed at first, keep trying. Many people need to try a few times before they quit smoking for good.



### Managing Related Problems

The related problems listed here can affect CAD. That’s why managing these problems is important:

- **High blood pressure.** Follow any dietary restrictions and exercise guidelines you’re given. And take your prescribed medications. You may also be told to monitor your blood pressure at home.
- **Cholesterol.** Follow your prescribed diet and take your medications as directed. Have your cholesterol and other lipids (blood fats) tested as often as your doctor says to.
- **Diabetes.** Work with your dietitian or diabetes educator to keep your blood sugar under control. This helps control other risk factors, such as high blood pressure and high cholesterol.
- **Stress.** Be aware that stress raises your heartbeat and blood pressure. Protect your heart by learning to relax. For instance, practice deep breathing or meditation.



# On Your Way to a Healthier Heart

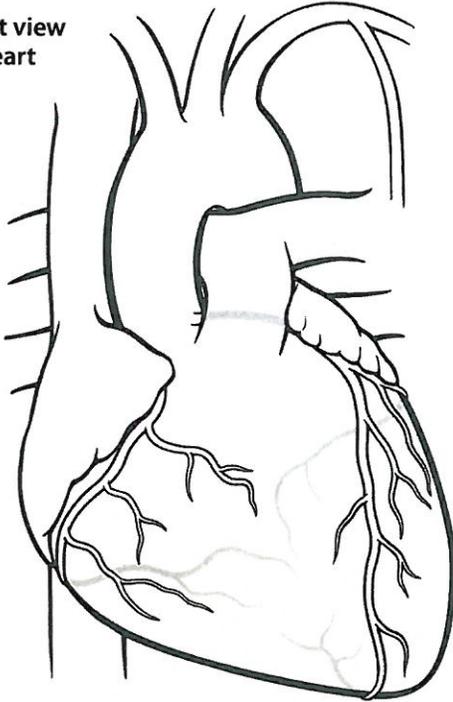
Remember that bypass surgery is not a cure. The only way to keep your heart healthy is to control your CAD risk factors. This may seem overwhelming at first. But you don't have to make all of these lifestyle changes at once. Think of the changes you make as slow, steady progress. And feel good knowing you're taking the first steps to a healthier future.

Where Can I Start?	What Else Can I Do?
<p>Start by choosing just one or two changes from the chart below. Once you've mastered them, try making others.</p>	<p>Write down your own ideas for working heart-healthy changes into your lifestyle.</p>
<p><b>Exercising</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> I will walk for at least 10 minutes during my lunch hour.</li> <li><input type="checkbox"/> I will talk to my doctor about joining a cardiac rehabilitation program.</li> <li><input type="checkbox"/> I will sign up for a low-impact aerobics class or join a walking group.</li> </ul>	<hr/> <hr/> <hr/> <hr/> <hr/>
<p><b>Heart-Healthy Eating</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> I will add more fresh fruits and vegetables to my diet.</li> <li><input type="checkbox"/> I will read food labels to choose products that have the least fat, cholesterol, and salt.</li> <li><input type="checkbox"/> I will get cookbooks with heart-healthy recipes from my local bookstore or library.</li> </ul>	<hr/> <hr/> <hr/> <hr/> <hr/>
<p><b>Quitting Smoking</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> I will ask my doctor about medications and products to help me quit smoking.</li> <li><input type="checkbox"/> I will join a smoking cessation class or ex-smoker's support group.</li> </ul>	<hr/> <hr/> <hr/> <hr/> <hr/>
<p><b>Losing Excess Weight</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> I will work with my doctor to set realistic weight loss goals.</li> <li><input type="checkbox"/> I will keep a record of what I eat. This can help me stay on my weight-loss plan.</li> </ul>	<hr/> <hr/> <hr/> <hr/> <hr/>

## Creating a New Pathway

Your doctor may draw on these pictures to show where arteries are blocked and where your bypasses may be done.

Front view  
of heart



Back view  
of heart



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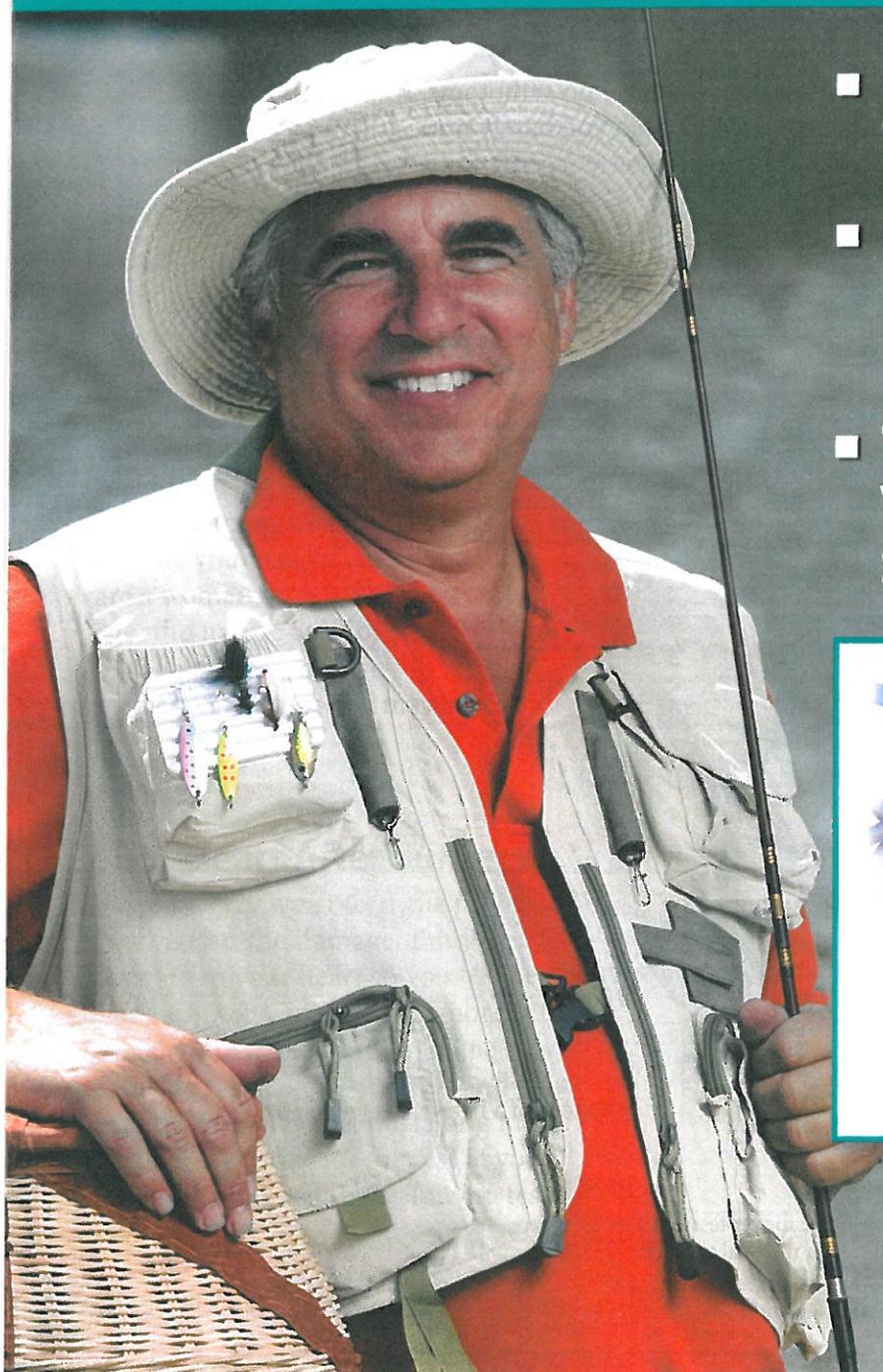
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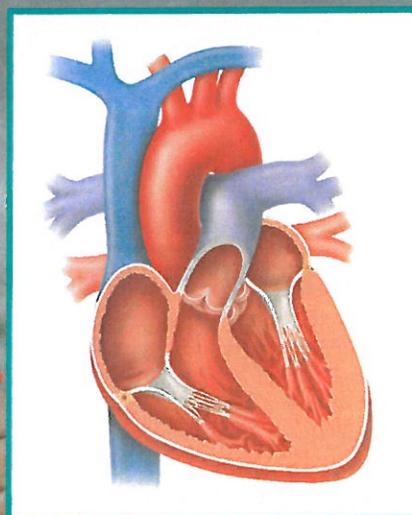
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# Understanding Heart Valve Surgery



- **Understanding Valve Problems**
- **Repair and Replacement Procedures**
- **Taking Care of Yourself After Surgery**



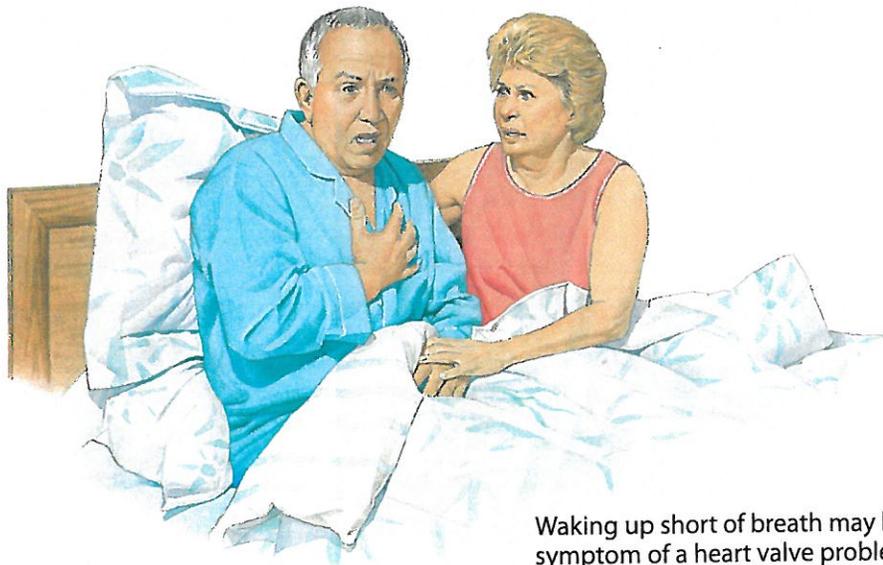
## Trouble with a Heart Valve

Your heart's job is to pump blood through your body. That job starts with pumping blood through the heart itself. Inside your heart, blood passes through a series of one-way gates called **valves**. If a valve works poorly, not enough blood moves forward. This can make you sick. But surgery can often fix the problem. This booklet will help you understand valve problems and show you what to expect before, during, and after surgery.

### Symptoms You Might Have

You can have a problem valve for decades yet have no symptoms. If you do have symptoms, they may come on so slowly that you barely notice them. In other cases, though, symptoms appear suddenly. You might have one or more of these symptoms:

- Problems breathing when you lie down, exert yourself, or get stressed emotionally
- Pain, pressure, tightness, or numbness in your chest, neck, back, or arms (angina)
- Feeling dizzy, faint, or lightheaded
- Tiredness, especially with activity or as the day goes on
- Waking up at night coughing or short of breath
- A fast, pounding, or irregular heartbeat
- A fluttering feeling in your chest
- Swollen ankles or feet



Waking up short of breath may be a symptom of a heart valve problem.

This booklet is not intended as a substitute for professional medical care. Only your doctor can diagnose and treat a medical problem.

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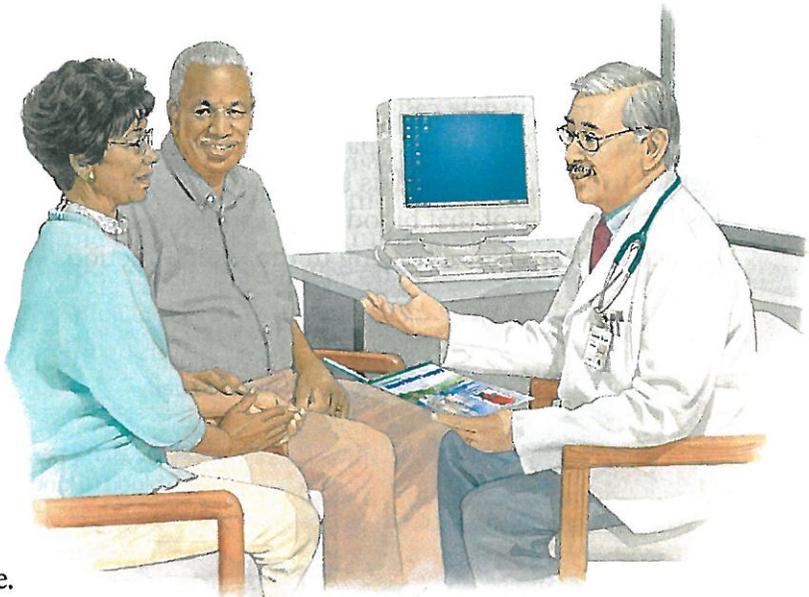
## Causes of Valve Problems

Men and women of any age can have heart valve trouble. You may have been born with a problem valve. Or a valve may have worn out as you've aged. It may not be possible to pinpoint what caused your valve problem. But common causes include:

- Buildup of calcium or scar tissue on a valve
- Rheumatic fever and certain other infections and diseases
- High blood pressure
- Other heart problems, such as coronary artery disease

## Surgery for Your Valve Problem

Your doctor will talk with you about surgery if it seems to be your best treatment option. During surgery, the problem valve will be either repaired or replaced. That decision will be based on many factors. These include your age, whether you are a woman of child-bearing age, the nature and location of the problem, and any other medical conditions you may have.



## Your Heart After Surgery

Valve surgery won't treat the problem that caused the damage. But it may strengthen your heart so you feel better. That way you can enjoy life more. After surgery you'll need to start some new habits to take care of yourself and your heart. These may include taking medications every day for the rest of your life and having regular follow-up tests.

### Notes to Family and Friends

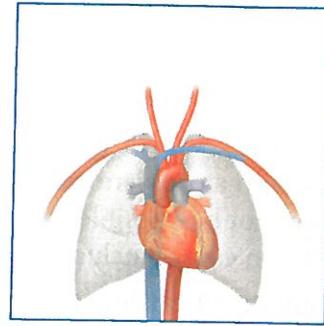
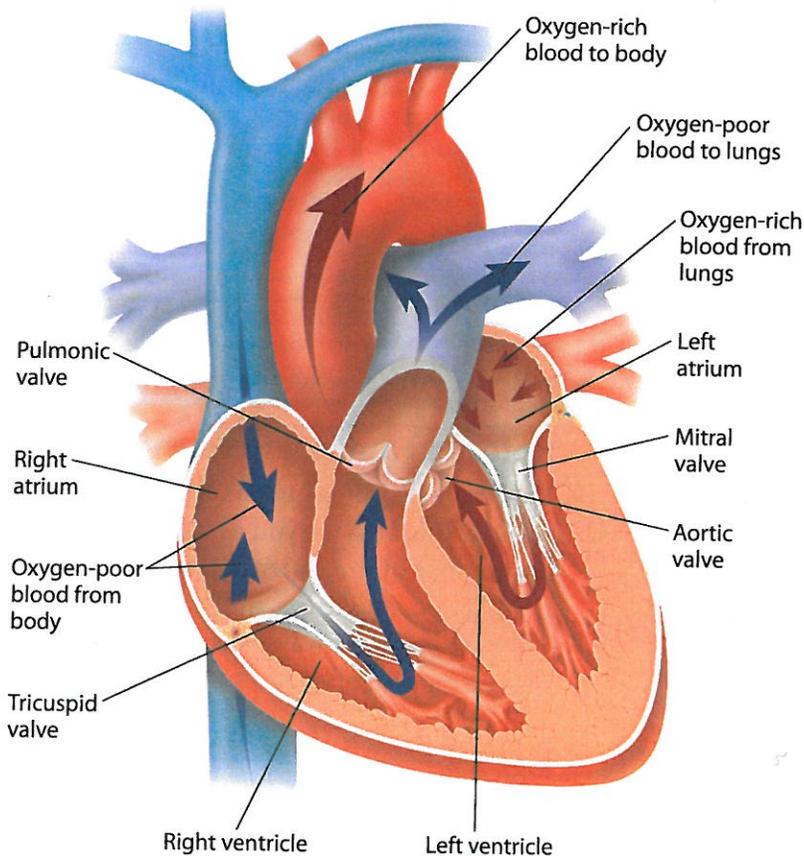
This booklet is not just for the patient. It is also for you as a friend or member of the patient's family. Look for boxes like this in the booklet. They will suggest ways you can help out during and after the surgery.

# How a Healthy Heart Works

Your heart is a pump that keeps your body supplied with oxygen-rich blood. The right side of the heart receives oxygen-poor blood from the body and sends it out to the lungs. The lungs add oxygen to that blood. The newly oxygenated blood then flows into the left side of the heart. The left side pumps it out to the rest of the body.

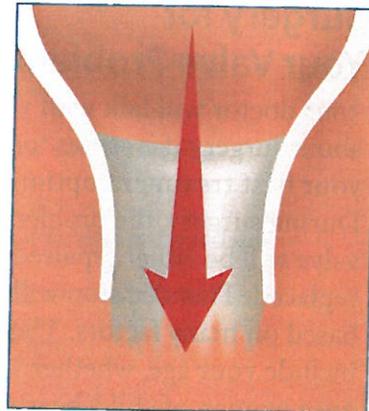
## Healthy Heart Valves

The heart has four chambers. Two are called **ventricles**, and two are called **atria**. As blood travels through the heart, it fills each chamber. It then exits each chamber through a one-way gate called a valve. Each valve has flaps called **leaflets**. They spread apart to open and then come together to close. Opening lets blood out of the chamber. Closing keeps any of that blood from leaking back in. This action keeps blood flowing in the right direction.

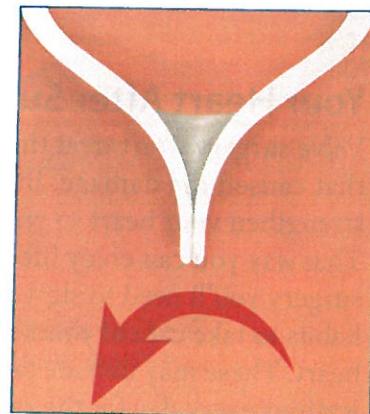


Your heart and lungs work together to keep the body supplied with oxygen.

## Healthy Valve



A healthy valve opens fully, so blood flows out of the chamber.

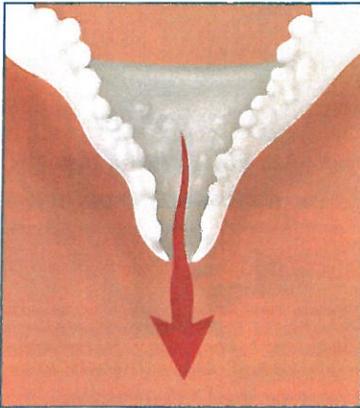


A healthy valve closes tightly, so blood cannot flow backward.

## When a Valve Doesn't Work Right

A problem valve may not open wide enough, not close tightly enough, or both. In any case, not enough blood gets sent out to the body. This causes the symptoms you feel. The heart tries to make up for that shortage by working harder. But working harder helps for only a while. If the problem isn't fixed, that extra work will damage the heart further. This can lead to **heart failure**, the inability of the heart to pump enough blood to meet the body's needs.

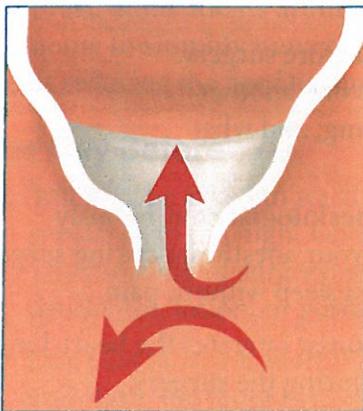
### Problem Valve



With **stenosis**, a valve doesn't open all the way, so not enough blood gets through.

### Problems Opening (Stenosis)

When a valve doesn't open all the way, the problem is called **stenosis**. The leaflets may be stuck together or too stiff to open fully. When the valve doesn't open fully, blood has to flow through a smaller opening. So the heart muscle has to work harder to push the blood through the valve.



With **regurgitation**, a valve doesn't close all the way, so some blood leaks backward.

### Problems Closing (Regurgitation)

When a valve doesn't close tightly enough, the problem is called **regurgitation** or insufficiency. The valve itself may be described as leaky. Leaflets may fit together poorly. Or the structures that support them may be torn. Some blood leaks through the valve back into the chamber it just left. So the heart has to move that blood twice.

## Preparing for Surgery

Once a valve problem has been diagnosed and surgery scheduled, you'll have some things to do. Some preparations will help make your surgery go smoothly. Some will help you get set up for your return home from the hospital. And others will help you feel more at ease. Your doctor will talk with you about the possible risks. Write down all your questions in advance so you don't forget to ask them.

### Tests You Might Have Just Before Surgery

You have already had several tests just to diagnose your valve problem. You will most likely have a few more to assess your overall health before surgery. These may include:

- An **ECG (EKG)** to show the rhythm of your heart.
- A **chest x-ray** to give your doctor more information about your heart and lungs, such as whether there is fluid in your lungs.
- **Blood and urine tests** to check for kidney problems, blood sugar levels, and the blood's ability to clot.



Bring someone with you to doctor visits to help you remember what the doctor says.

### Your Healthcare Team

You may meet only some members of your healthcare team before surgery. But each will have an important role in your care. They keep one another informed about what they have done for you, how you're doing, and what you need. Your team may include the following:

- A **primary care doctor** provides ongoing care; may be your cardiologist, internal medicine specialist, or general practitioner.
- A **surgeon** and surgical assistants perform the operation itself.
- **Nurses** each specialize in a different phase of your care, such as helping during the surgery or your recovery in the ICU.
- An **anesthesiologist** continuously monitors your anesthesia during surgery to help you sleep without pain.
- A **perfusionist** operates the heart-lung machine during the surgery.

## To Do Before Surgery

Steps you take before your surgery can help make both the surgery and your recovery go better. Follow your doctor's instructions.

### The Weeks Before

- ❑ Ask your doctor about scheduling any dental work you might need. Dental work may let bacteria into your bloodstream, which may cause infection on a new valve.
- ❑ Give your doctor a list of every medication you take, including supplements and over-the-counter products. Your doctor may have you stop taking some of them or start taking others before surgery.
- ❑ If you smoke, quit right away. You will do better during and after the surgery.
- ❑ Arrange for an adult family member or friend to drive you home from the hospital. Have a helper available for your first week or two at home.
- ❑ Prepare and freeze food or arrange to have food brought in while you recover.
- ❑ Make adjustments around your home to simplify movements, such as reducing the need to climb stairs.

### The Day Before

- ❑ You may be asked to wash with special soap the night before surgery. The morning of surgery, don't use deodorant, lotion, or perfume.
- ❑ Don't eat or drink anything after midnight, the night before surgery.



Make a list of all your medications and dosages.

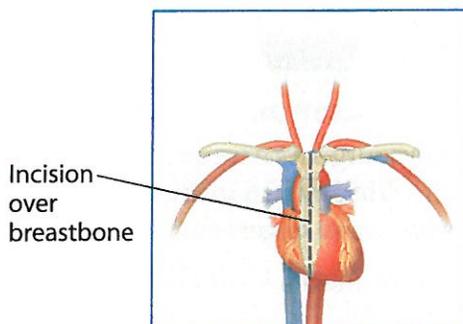
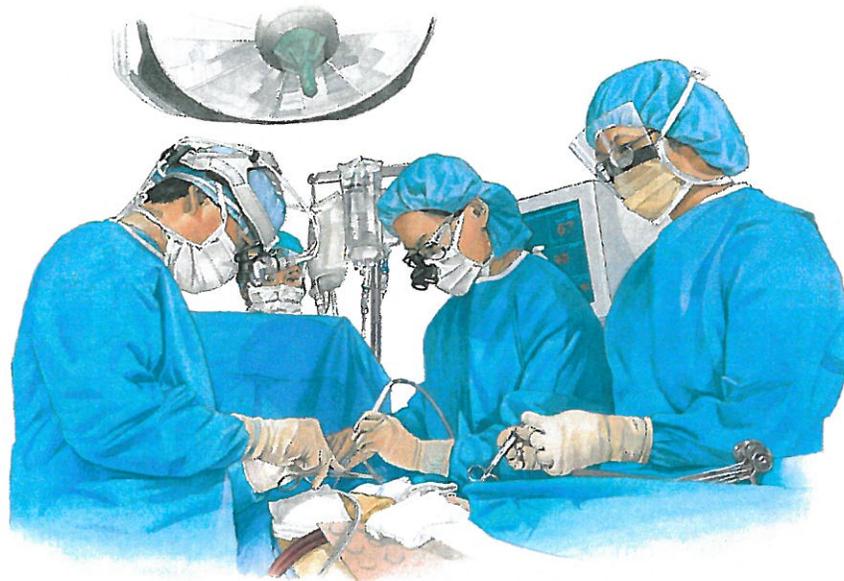
### Risks and Complications

Most valve surgeries have an excellent outcome. But any major surgery carries risk. Valve surgery risks include:

- Bleeding; need for a transfusion
- Infection
- Blood clot
- Heart rhythm problems, stroke, heart attack, or death
- Problems in the lungs or kidneys
- Failure of the new or repaired valve
- Damage to the heart

## Your Surgery

You can feel confident knowing that a team of skilled experts is doing your valve surgery. Your surgeon will first gain access to your heart. Then he or she will either repair or replace the problem valve. If you have another heart problem, a second procedure may be done at the same time to take care of it, too. A heart-lung machine will oxygenate your blood so your heart and lungs can be still during the surgery.



### Reaching Your Heart

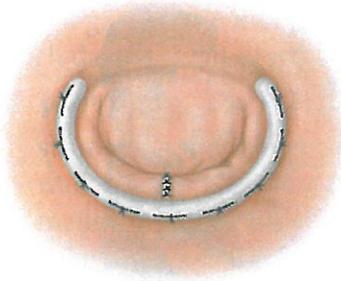
To get to the heart, the surgeon usually makes an incision down the center of the chest. The **breastbone** (sternum) is then separated. After surgery, the breastbone is rejoined with wires. The incision is then closed. In many cases, the breastbone heals in 6 to 8 weeks. If your surgeon plans to reach your heart by a different means, he or she will discuss it with you.

### Notes to Family and Friends

- The entire surgery can take 4 to 6 hours. Plan some activities, such as card games or reading, to help you relax while you wait.
- Be sure at least one person is always in the waiting room to receive news.
- Remind yourself that your loved one is in good hands.

## Three Ways to Treat Problem Valves

Different problems call for different treatments. Your doctor will talk with you in advance about the treatment that is best for you. In some cases, though, the plan may need to change once surgery has begun. The three basic ways to treat valve problems during surgery are:



A ring for one kind of repair

### Repair of the Valve

Whenever they can, surgeons prefer to repair a valve rather than replace it. The most common kind of repair involves sewing a ring around the entrance to a valve to improve its size or shape. Another involves cutting tissue to let leaflets open or close better. When repair isn't possible, the valve will be replaced.



A mechanical valve

### Replacement with a Mechanical Valve

Mechanical valves are made of metal or hard carbon. There are many designs. They can last for decades. But blood tends to stick to them, forming clots. So if you receive a mechanical valve, you have to take **Coumadin**, an **anticoagulant** medication, for life to prevent blood clots. See pages 14 and 15 to learn more about Coumadin.



A tissue valve

### Replacement with a Tissue Valve

A tissue valve usually comes from a pig or a cow. Blood does not clot as easily on tissue valves. So patients getting tissue valves may need Coumadin for only a short time. Aspirin is sometimes used instead. Tissue valves may wear out faster than mechanical valves. So they may have to be replaced sooner.

## Fixing Other Problems

If you have a valve problem, you may have some other heart problem, too. If so, there is no better time to fix it than while you are already in the operating room. So it is common for surgeons to plan to combine needed procedures. For instance, you might need a coronary artery bypass at the same time as valve surgery. Two procedures may mean more risk than one. If a second procedure is needed, your doctor can tell you more.

## Recovering in the Hospital

After surgery, you'll spend at least a day in the intensive care unit (ICU). Highly trained nurses will monitor you closely. When you're ready, you will be moved to a general care room. You'll stay there for 2 to 8 days. While there, you'll recover further and prepare to go home.



### In the ICU

When you first wake up after surgery, you may feel groggy, thirsty, or cold. You'll be connected through tubes and wires to several devices. A tube may be in your throat to help you breathe. You won't be able to talk while this tube is in place. Once it is removed, your nurses will teach you exercises to clear your lungs and get your breathing back to normal. If you feel pain, ask for more medication. Don't wait until the pain gets bad.

### Beyond the ICU

The more you stand and walk, the better—even if doing so makes you tired. Walking improves your muscle strength, blood flow, and breathing. Before you go home, your doctor will check the dosages of your medications. You'll go home when you're able to, but don't expect to feel fully recovered. Have an adult family member or friend drive you home. Have someone stay with you for a week or two.

### Notes to Family and Friends

- You may be able to visit your loved one briefly a few hours after surgery.
- Be prepared to see him or her groggy, pale, puffy, confused, and surrounded by tubes and monitors. This is normal after open heart surgery.
- Encourage him or her to accept pain medication as needed before the pain becomes severe.
- Encourage your loved one to get out of bed to stand and walk as much as he or she can.

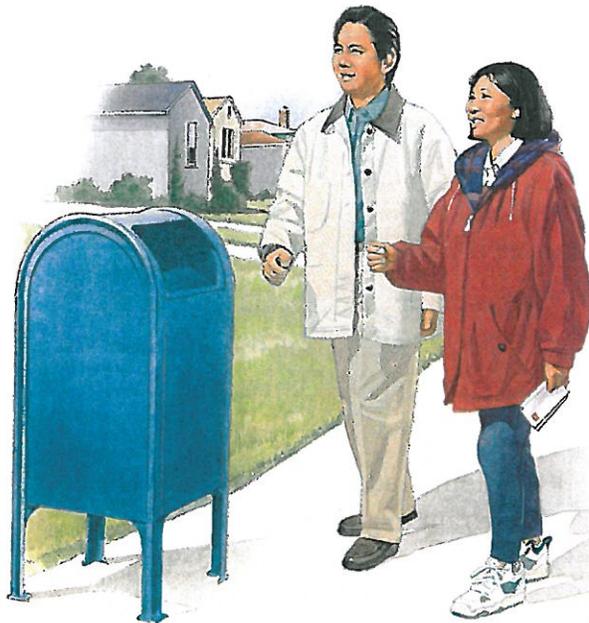
## Recovering at Home

You've just come through one of the major events of your life. So give yourself time to get better little by little. Expect good days and bad days. At first, you may tire easily. But being active will help you recover. Find your right balance between rest and activity.

### Easing Back into Daily Activities

You'll gain a little more energy and strength each day. Start off easy with activities such as:

- **Walking.** One of the best ways to get stronger is simply to walk. Start with short walks inside your home, then out to the mailbox. Walk a little more each day. Take someone with you at first.
- **Showering.** You may feel weak the first few times you shower. Put a stool in the shower. Have someone nearby in case you need help. Avoid very hot water or tub baths, which can make you lightheaded.
- **Returning to work.** Ask your doctor when you can return to work. You may need to work part-time at first.



### Caring for Your Incision

It is normal for your incision to be numb, bruised, itchy, or sore for a few weeks. Gently wash it daily with warm water and soap. Then pat it dry. To prevent infection, keep skin lotions and ointments off your incision.

#### When to Call Your Doctor

Call your doctor if any of the following occurs:

- You are short of breath while resting or after only a little exertion.
- Your heart seems to be beating fast or slow or is skipping beats (palpitations).
- Your legs swell or you gain more than 2 pounds in 1 day or 5 pounds in 1 week (retaining fluids).
- You feel dizzy or lightheaded.
- You have chills or fever of 100°F (37.7°C) or higher.
- Your incision changes for the worse, such as swelling, oozing, or getting red or tender. Call your surgeon.
- Pain in your chest or shoulder gets worse instead of better.
- Your breastbone clicks or grinds.

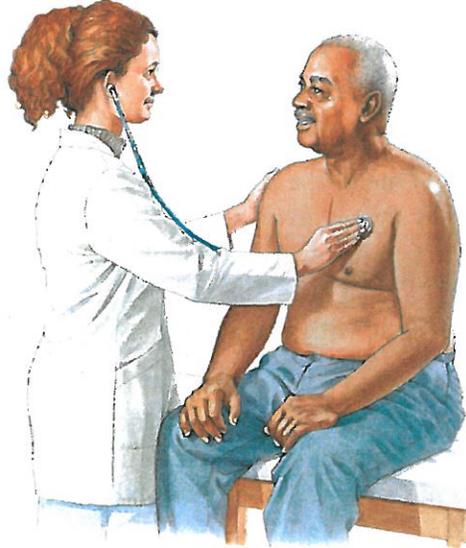
## The Weeks and Years Ahead

Everyone recovers at a different rate. But expect to take about 6 to 8 weeks before you can get back to your routine. Giving your heart and chest time to heal properly will pay off in your future health. To keep feeling your best, you'll need regular checkups for the rest of your life.

### Visiting Your Doctor

Follow-up visits with your doctor help make sure you're recovering well. You may have:

- Blood tests to track your progress and see if you need more or less medicine.
- Chest x-rays or echocardiograms to check how well your heart is working.
- ECGs to show if your heart's rhythm has changed.
- A monitored exercise and learning program to guide your recovery.



Regular checkups help keep your recovery on track.

### Preventing Infection

Bacteria can damage your new heart valve. It can get into your bloodstream from routine dental work and some medical procedures. So before any such procedure, you'll need to take antibiotics. Tell all your doctors and dentists you've had valve surgery. Ask your cardiologist about any other guidelines.

### Letting Your Breastbone Heal

For at least 4 to 6 weeks, avoid activities that put strain on your chest. For example, steering a car can make your breastbone hurt. So let others drive during this time. Also, don't lift, push, or pull anything that weighs more than 5 or 10 pounds, such as a grocery bag, vacuum, or mower. After a few weeks, you can do light housework such as dusting or minor household repairs. You can resume sex as soon as you feel comfortable. But avoid sex positions that put stress on your chest or arms.

### Keeping Your Mood in Perspective

While getting over major surgery, many people feel depressed or frustrated. You might feel cheerful and full of energy one day, then cranky and tired the next. You may find it hard to concentrate or have trouble sleeping. These problems are common after major surgery and should go away. If they hang on longer than a few weeks, tell your doctor. Keep talking with your family and friends to support each other.

## Forming New Habits

You may need to make changes in your lifestyle to protect your heart. These include:

- **Exercise.** Make walking and other exercise part of your routine. Start off easy, and do more little by little. Set a goal of someday walking 30 minutes a day. Check with your doctor before resuming any activity that could lead to injury, such as skiing or construction work.
- **Quit smoking.** Smoking is very bad for your heart and lungs. If you need help quitting, ask your healthcare provider.
- **Limit salt (sodium).** Salt makes fluid build up in your body. That makes your heart work harder and can lead to heart failure. Your doctor may advise you to replace salt with other seasonings.
- **Avoid alcohol.** Don't drink any alcohol during your first month after surgery. Some medications may require avoiding alcohol for as long as you take them.
- **Control weight.** If you need to lose weight, ask your doctor for advice.

## Monitoring Yourself

Keeping a few simple records will help you and your doctor track your progress.

- **Weight.** Weigh yourself daily and write your weight down. Call your doctor if you gain more than 2 pounds in a day or 5 pounds in a week.
- **Pulse and blood pressure.** Ask to be shown how to take your pulse and blood pressure. Take it regularly and track the numbers. Show your doctor this record at each visit.



Walk in a mall or other safe place with a smooth surface.

## Notes to Family and Friends

- Encourage your loved one to move steadily back into activity. Your support for each effort can boost his or her confidence.
- For 1 to 2 weeks, be close at hand most of the time. Check in often.
- You too may feel depressed or frustrated after your loved one's surgery. Talk to each other about your feelings.
- Try not to be overprotective. Let your loved one do what he or she feels able to do comfortably.

## Preventing Blood Clots

Any foreign object placed in your heart will have tiny spaces where a blood clot could form. If a clot does form, it could travel to your brain or somewhere else in your body. That could cause a stroke or other severe problems, even death. If you are prescribed anticoagulant medication to prevent clots, these two pages are for you.

### Medication to Prevent Clots

You will need aspirin or an anticoagulant pill called Coumadin (also called warfarin) to prevent blood clots. If you received a mechanical valve, you most likely will need to take Coumadin for the rest of your life. If you don't get a mechanical valve, you may need to take it for only a few months.

- Take Coumadin at the same time each day. If you miss a dose, take the next one at the normal time. Never take two doses at once.
- Check with your healthcare provider before taking any other medications (even aspirin) or vitamin or herbal supplements.
- With Coumadin, bleeding takes longer to stop. So avoid using sharp tools, going barefoot, and doing anything else that might cause bleeding. Always wear medical ID jewelry that says you're taking an anticoagulant.
- Go for your blood tests as often as directed. These tests are the only way to check if your Coumadin dosage is right. Ask your doctor whether you can use a home blood test product.



### Risks of Anticoagulant Therapy

Long-term anticoagulant therapy has some risks. They include life-threatening bleeding and (when taken by a pregnant woman) birth defects. **CAUTION: Taking aspirin, aspirin-containing medications, or ibuprofen while on anticoagulant therapy can be dangerous. Ask your doctor before taking any medication. Alcohol and certain foods can also affect how your anticoagulant works, so talk with your doctor.**

## The Role of Vitamin K

Vitamin K and Coumadin have opposite effects. Your body uses vitamin K to help blood form a clot. Coumadin makes it harder for your body to process vitamin K. So Coumadin slows down clotting. Your doctor must find the right balance between the amount of vitamin K you get and the amount of Coumadin to prescribe.

## Keeping Your Diet Steady

Some foods are high in vitamin K. Whether you eat a lot or a little of those foods, eat the same amount of them every day. Avoid supplements that contain vitamin K. If you change your diet for any reason, such as to lose weight or due to travel, tell your doctor. Foods high in vitamin K include:

- Broccoli
- Cabbage and cole slaw
- Spinach
- Asparagus
- Avocado
- Lettuce
- Brussels sprouts
- Greens (collard, turnip, mustard, kale, Swiss chard)
- Seaweed



Every day, eat the same amount of foods that are high in vitamin K.

## Two Numbers to Track

You'll need just the right amount of Coumadin—not too much, not too little. The amount you need may change over time. The right amount depends on how long your blood takes to clot. Regular blood tests measure that time with an “INR” and/or “PT” number. Keep a log of your INR numbers and know the target INR range your doctor has set for you. Keep all of your appointments for blood tests.



## When to Call Your Doctor

If you take Coumadin and any of these occurs, call your doctor:

- You have any unexpected bruising or bleeding.
- You cut or injure yourself, and serious bleeding does not stop in 15 minutes.
- You have severe or frequent headaches.
- You have dark or tarry stools, your urine is dark or bloody, or you vomit blood.

# Your Anticoagulant Record

If your doctor prescribed Coumadin to prevent blood clots, this page is for you. Photocopy this page or create your own notebook based on it. Fill in the spaces each time you have your blood checked. Share your record with any doctor you visit.

## Target INR Range

Ask your doctor what yours is. Write it here:

Date	Target Range

Date	Coumadin dosage	INR	PT	Comments

**PLEASE PHOTOCOPY THIS PAGE**

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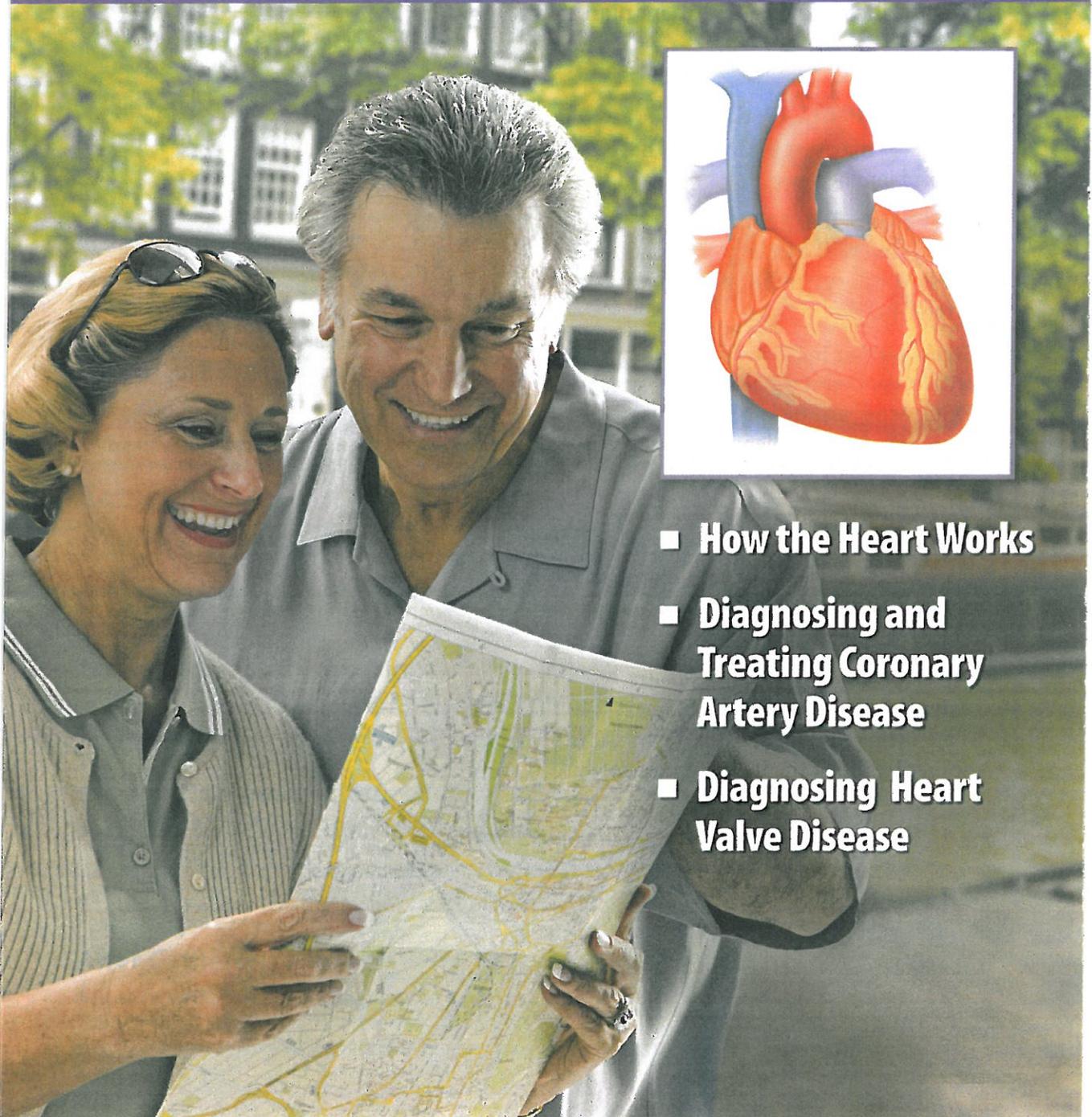
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# Understanding Cardiac Catheterization



- **How the Heart Works**
- **Diagnosing and Treating Coronary Artery Disease**
- **Diagnosing Heart Valve Disease**

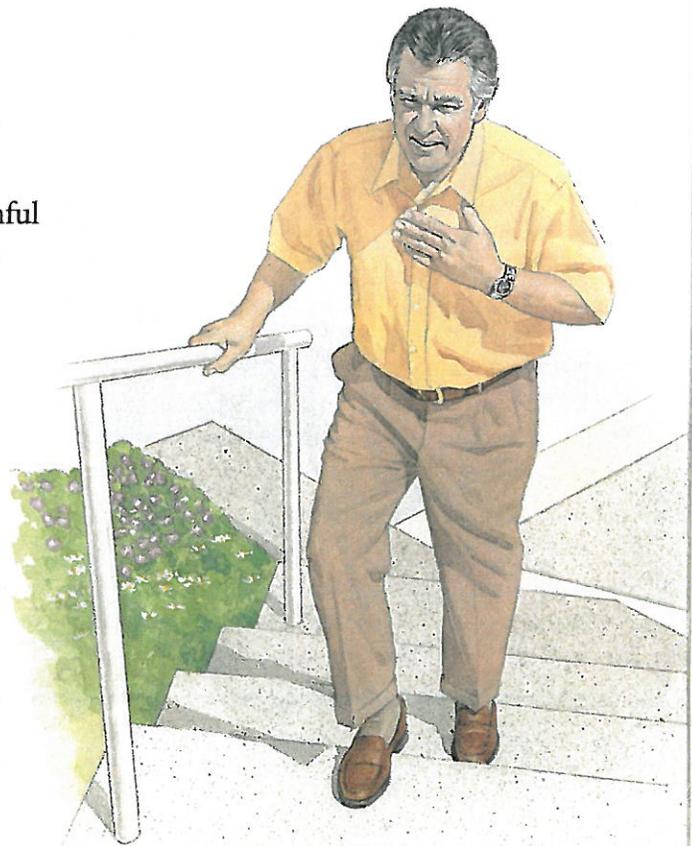
## Looking into Your Heart Problem

Your doctor may have given you this booklet because you have signs or symptoms of heart trouble. Or, test results may suggest that you have a heart problem such as coronary artery disease (CAD) or valve disease. Left untreated, these conditions can lead to a heart attack or heart failure. The good news is that **cardiac cath** (catheterization) can help to confirm, and in many cases treat, heart problems. Read this booklet to learn how cardiac cath can help your doctor form a treatment plan that's right for you.

### Signs of Heart Trouble

Your doctor may suspect that you have a heart problem because:

- **You have angina.** Angina can be a painful or uncomfortable feeling in or near the chest. It is a symptom of coronary artery disease.
- **Stress testing indicates a problem with your coronary arteries.** A stress ECG, echocardiogram, or nuclear scan can show problems that occur when the heart works harder.
- **You have symptoms of heart valve or heart muscle problems.** These symptoms include weakness, dizziness, shortness of breath, and swollen legs, ankles, or feet.
- **An echocardiogram shows heart valve or heart function problems.** This ultrasound of the heart can show some details of the heart structure.



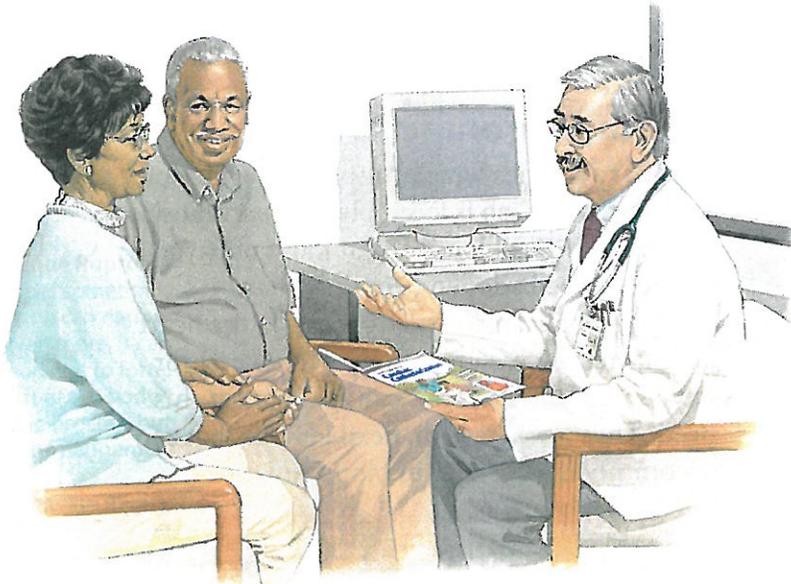
Angina often occurs during activities that make the heart work harder, such as climbing stairs.

This booklet is not intended as a substitute for professional medical care. Only your doctor can diagnose and treat a medical problem.  
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## Diagnosing Heart Problems with Cardiac Cath

Cardiac cath is a common nonsurgical procedure. It is done using a **catheter** (a long, thin, flexible tube). The catheter is inserted into a blood vessel and guided to the heart. This allows your doctor to gather information about the coronary arteries and the structure and function of the heart. It's also the first step in certain procedures to improve heart function. Cardiac cath can:

- Show whether the blood vessels supplying the heart muscle are narrowed or blocked.
- Show whether the heart is pumping normally and blood is flowing properly through the heart.
- Help your doctor to form a treatment plan based on test results.
- Make treatment of certain heart problems possible.
- Rule out certain heart problems.



## Table of Contents

### How the Heart Gets Oxygen

- Learn how the coronary arteries supply the heart with oxygen-rich blood, and what happens when they become blocked ..... page 4

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- Read about how valves control blood flow through the chambers of the heart. Learn how heart valve problems affect heart function ..... page 6

### Cardiac Catheterization

- Find out how cardiac cath works, and what to expect during the procedure ..... page 8
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### After Catheterization

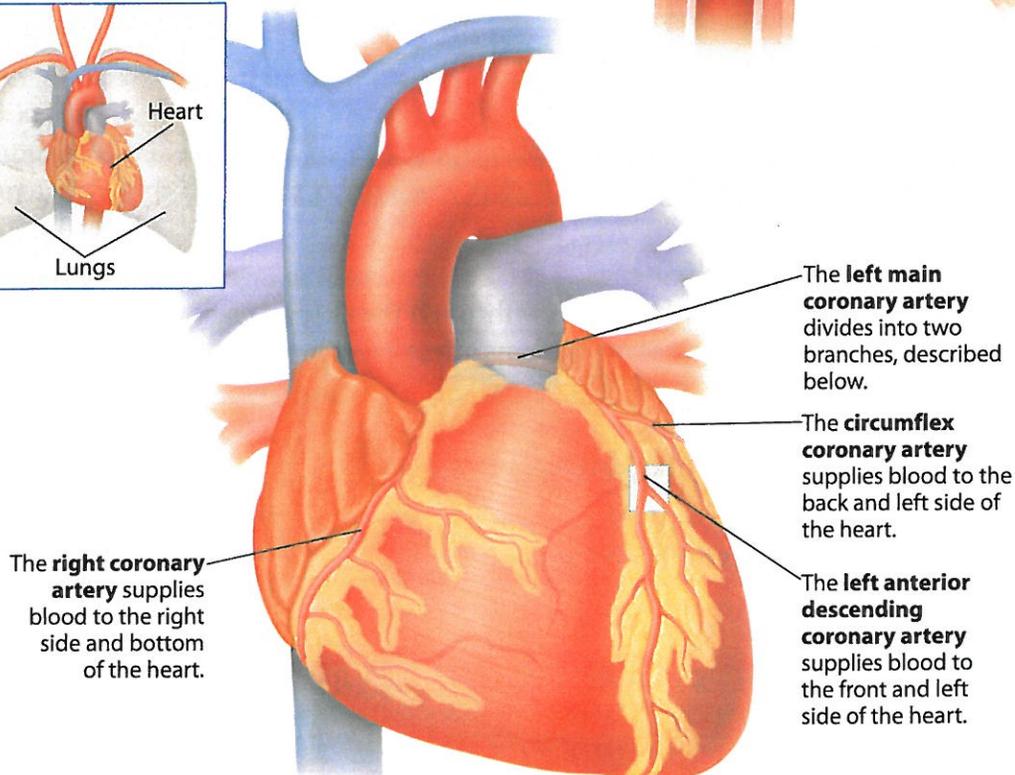
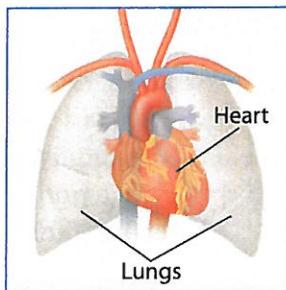
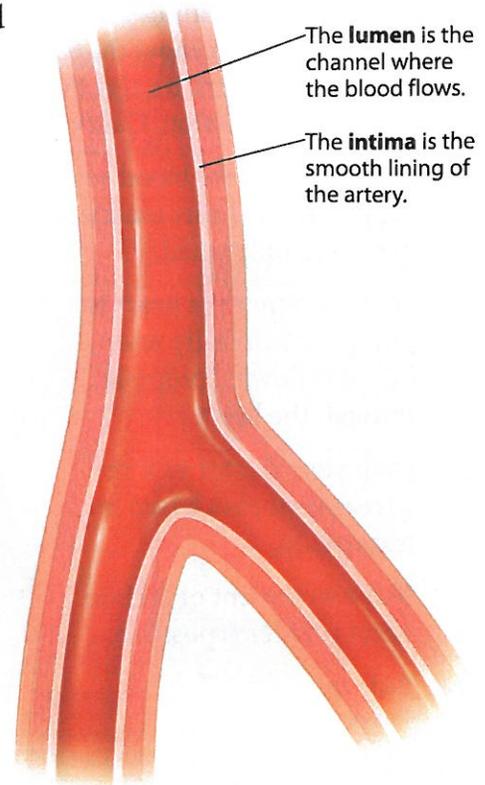
- Learn what to expect during your recovery, and what happens next ..... page 13

## How the Heart Gets Oxygen

The heart is a muscle that pumps blood throughout the body. Like other muscles, the heart needs a steady supply of oxygen to function. Blood carries oxygen to the heart and the rest of the body through blood vessels called **arteries**. In the heart, the coronary arteries supply blood and oxygen to the heart muscle. If the heart doesn't get enough oxygen, angina or a heart attack can result.

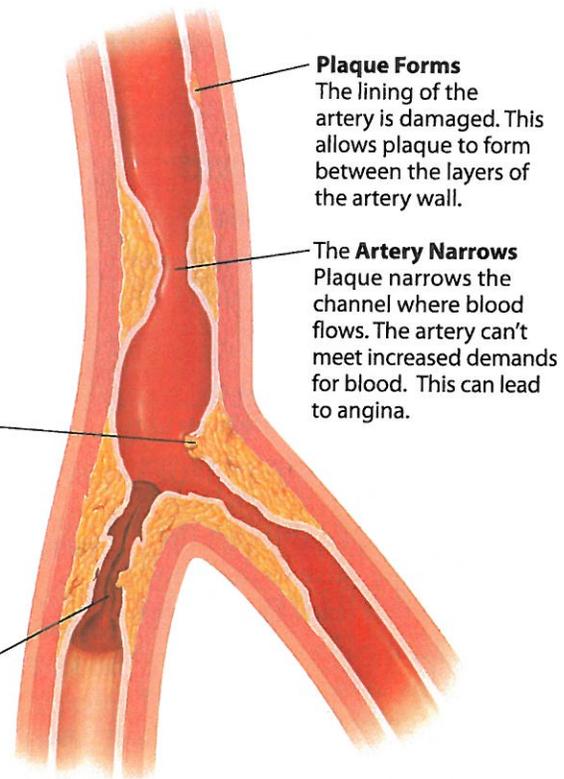
### Healthy Coronary Arteries

Coronary arteries wrap around the surface of the heart. Their job is to supply the heart muscle with oxygen-rich blood. The amount of oxygen the heart needs depends on how hard it's working. For example, exercise makes the heart beat faster, increasing the muscle's need for oxygen. Healthy arteries can easily meet this need. They have smooth, flexible walls that can accommodate changes in blood flow.



## Coronary Artery Disease

Coronary artery disease starts when the lining of a coronary artery is damaged. This is often due to risk factors, such as smoking or high blood cholesterol. **Plaque** (a fatty material composed of cholesterol and other particles) then builds up within the artery wall. This buildup (called atherosclerosis) narrows the space inside the artery. It also makes artery walls less able to expand. At times when the heart needs more oxygen, not enough blood can get through to meet the need. This can lead to angina.

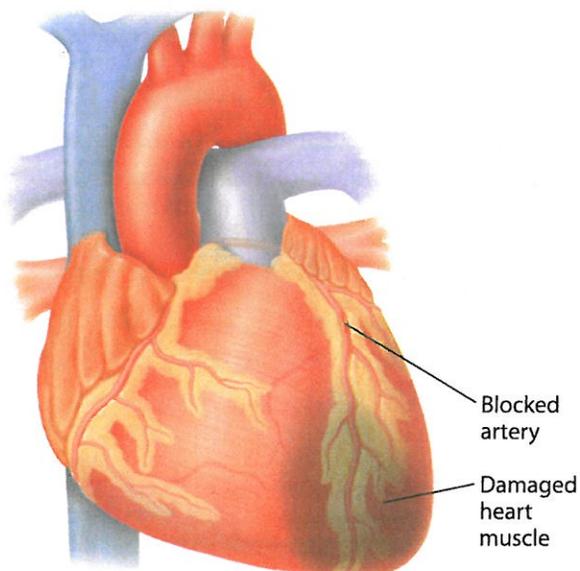


**Plaque Forms**  
The lining of the artery is damaged. This allows plaque to form between the layers of the artery wall.

**The Artery Narrows**  
Plaque narrows the channel where blood flows. The artery can't meet increased demands for blood. This can lead to angina.

**Plaque Ruptures**  
Plaque deposits sometimes rupture. A rupture can narrow the artery even more. It can also cause a blood clot to form. This is part of the body's healing process, but it can also be dangerous.

**A Blood Clot Blocks the Artery**  
If a blood clot cuts off blood flow in the narrowed artery, angina or a heart attack results.



## Heart Attack

A heart attack (myocardial infarction) occurs when a coronary artery is blocked by plaque or a blood clot. When this happens, the heart muscle beyond the blockage doesn't receive enough oxygen. That part of the heart muscle begins to die. This damage cannot be reversed. Though many people survive heart attacks, a heart attack can be deadly.

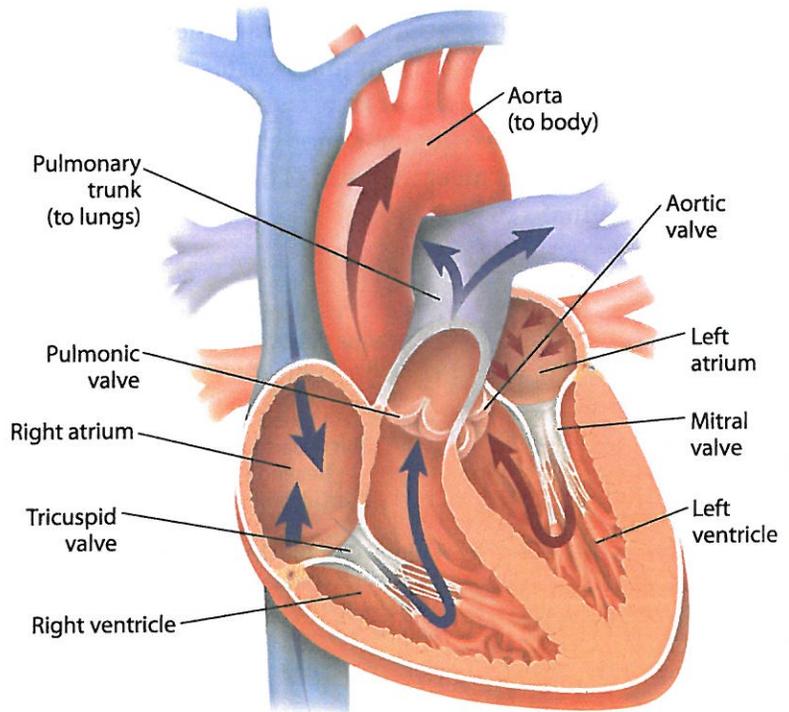
# How the Heart Pumps Blood

The heart is a system of chambers and valves that keep blood moving in the correct direction. The heart muscle squeezes (beats) to move blood in and out of the heart's four chambers. (These chambers are called **ventricles** and **atria**.) Four valves open and close to keep blood moving in the proper direction through the heart.

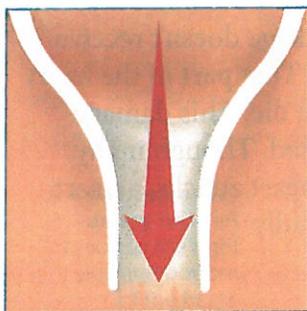
## Valves Direct Blood Through the Heart

With each heartbeat, valves open and close. This moves blood in the correct direction.

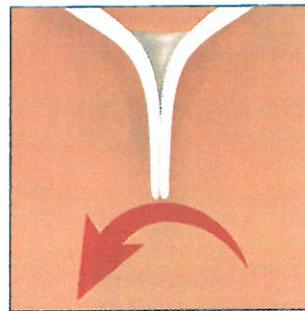
- **Oxygen-poor blood** is pumped from the right atrium through the tricuspid valve into the right ventricle. It is then pumped through the pulmonic valve to the blood vessel that leads to the lungs. There, it picks up oxygen and returns to the heart through the pulmonary veins.
- **Oxygen-rich blood** is pumped from the left atrium through the mitral valve into the left ventricle. It is then pumped through the aortic valve to the aorta, so it can travel to the rest of the body.



Oxygen-poor blood (blue arrows) is pumped to the lungs. Oxygen-rich blood (red arrows) is pumped to the rest of the body.



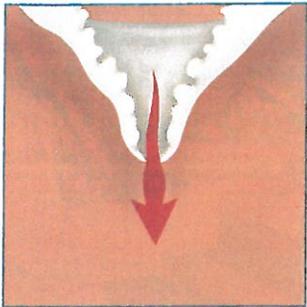
A valve opens to let blood move forward.



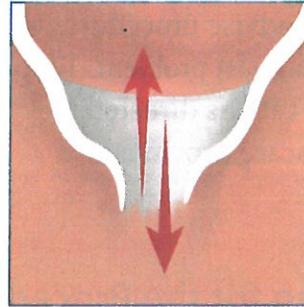
A valve closes to keep blood from leaking backward.

## Valve Problems

Valve disease occurs when a valve doesn't open or close properly. When this happens, the heart has to work harder to move the same amount of blood. Over time, this can cause the heart muscle to tire and weaken, leading to heart failure.



Narrowed valve



Leaky valve

### Problems Opening (Stenosis)

Stenosis (also called valvular narrowing) occurs when a valve doesn't open all the way. Scarring or deposits of calcium can make a valve stiff and hard to open. This means that blood has to flow through a smaller opening. So the heart muscle has to work harder to push blood through. Stenosis can get worse over time.

### Problems Closing (Insufficiency)

Insufficiency (also called regurgitation) occurs when a valve doesn't close tightly enough. A valve may have extra tissue, or be loose or shortened. Or the structures that support the valve may be torn. When this happens, blood leaks backward through the valve. The heart has to move some of the same blood over again. Insufficiency can also worsen over time.

## Other Heart Structure Conditions

In addition to CAD and valve problems, cardiac cath is used to diagnose other types of heart problems. These include heart muscle problems and congenital heart problems.

### Heart Muscle Problems

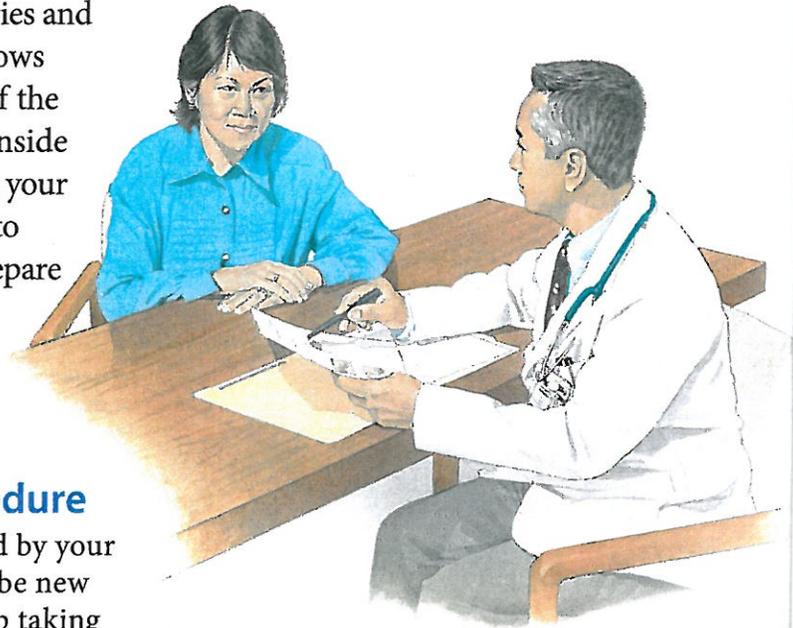
The heart muscle can weaken for many reasons. A weakened heart loses the ability to pump enough blood to the rest of the body. This is called heart failure. If you have heart failure, cardiac cath may be used to find the cause so that the underlying problem can be treated.

### Congenital Heart Problems

Most heart problems develop as people age. But some people are born with heart problems (congenital heart disease). These problems include structural ones such as a hole between two of the heart's chambers. Cardiac cath can be used to find out how a congenital problem is affecting heart function.

## Cardiac Catheterization

During this procedure, catheters are inserted into the coronary arteries and chambers of the heart. This allows your doctor to take pictures of the coronary arteries and do tests inside the heart. Based on the results, your doctor may advise procedures to correct your heart problem. Prepare for cardiac cath as directed by your healthcare provider.



### Preparing for the Procedure

- Take medication as prescribed by your doctor. He or she may prescribe new medications or ask you to stop taking certain medications before cardiac cath.
- Do not eat or drink after the midnight before the procedure.
- Arrange for a ride home after the procedure. Pack a bag in case you need to stay in the hospital overnight.
- Read and sign the consent form.

### Possible Risks

Any procedure involves some risk. Although complications of cardiac cath are rare, risks may include:

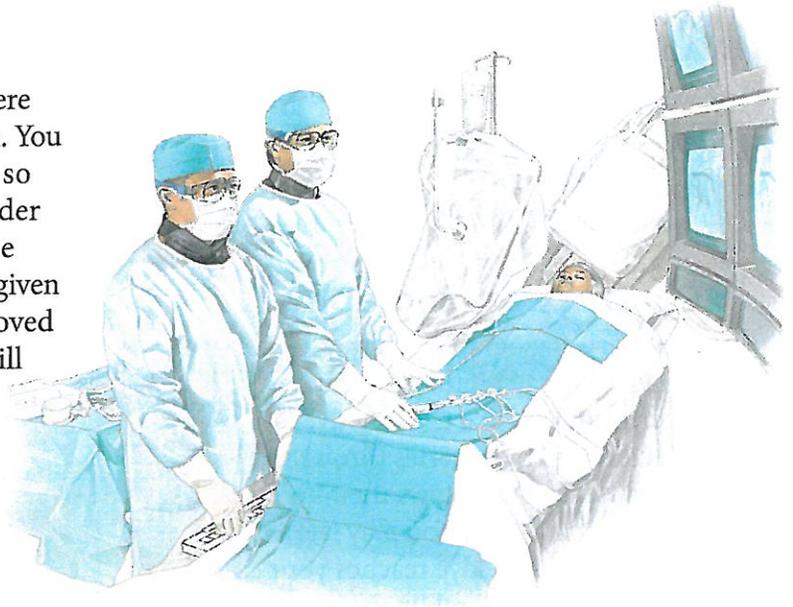
- Bleeding from or infection of the catheter insertion site
- Allergic reaction to the x-ray dye
- Abnormal heartbeat (arrhythmia)
- Tearing of the artery lining
- Kidney damage or failure
- Heart attack, stroke, or death (very rare)
- The need for emergency cardiac surgery (very rare)

### Be Sure to Tell Your Doctor:

- **About any medications you take.** Include herbs, supplements, or over-the-counter medications.
- **If you are allergic to iodine or any medications.** The x-ray dye used during the procedure contains iodine. If needed, you will be given medication to help prevent an allergic reaction.
- **If you are pregnant or think you could be pregnant.** Cardiac cath may need to be postponed until after the baby is born.

## Before the Procedure

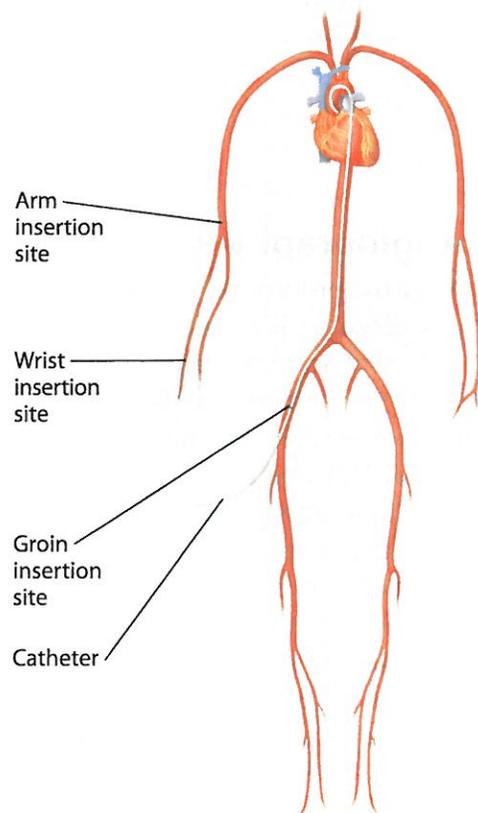
You'll be taken to a prep room, where you can change into a hospital gown. You may be in the lab for a few hours, so you'll be asked to empty your bladder and bowels. An IV line will then be started. Medication or fluid may be given through this line. Hair may be removed from the skin where the catheter will be inserted. You are then taken to the cath lab.



## In the Cath Lab

Once in the cath lab, you'll lie on an x-ray table. You will be given a sedative to help you relax. You may remain awake throughout the procedure:

- The skin in the area of the insertion site is numbed. An introducing sheath is inserted into an artery in the groin, arm, or wrist. The sheath remains in place during the entire procedure.
- If you are having a right-heart cath (see page 12) a sheath will also be placed in a vein in the same area. (Veins are blood vessels that carry blood back to the heart.)
- A catheter is slid over a guide wire. The guide wire is then inserted into the sheath and threaded through the blood vessels to the heart. Since blood vessels have no pain nerves, you won't feel this.
- The guide wire is removed, leaving the catheter in place.
- During the procedures that follow, the guide wire and catheter may be removed and replaced several times. This is done to reach each of the coronary arteries or heart chambers.

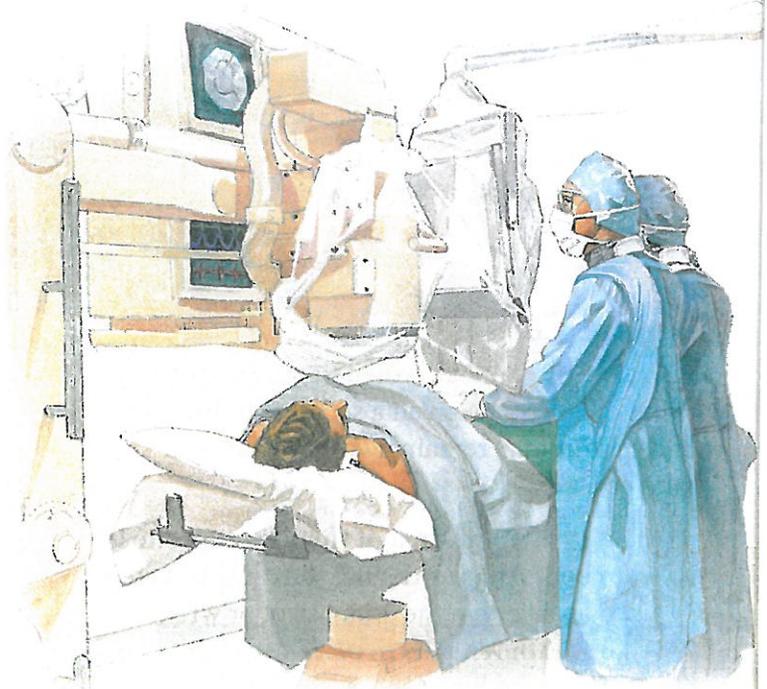


## Viewing and Treating Coronary Arteries

**Angiography** involves taking x-ray pictures of blood vessels. These x-rays can show the location and severity of blockages in the vessels. This can help in forming a plan to open or bypass these blockages.

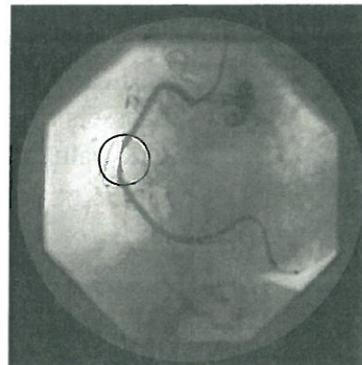
### Coronary Angiography

Coronary angiography is a way of taking x-ray pictures of the arteries in the heart. X-ray dye is injected into the arteries through the catheter. This allows them to show up on x-rays. You may feel a warm flush as the dye reaches your bloodstream. Several images are then taken, showing the locations of any blockages. Your doctor may ask you to hold your breath or to cough. As pictures are taken, the lights may be dimmed and you may hear the noise of the camera.



### Angiography Results

After the procedure, your doctor will discuss the results with you. This may occur while you're still on the table or after you've been moved to another area. In many cases, angioplasty and stenting can be used to improve blood flow. These procedures may be done right away or scheduled for a later date. But depending on factors, including the number and locations of blockages, your doctor may advise coronary artery bypass surgery instead. This surgery will be planned for a future date.

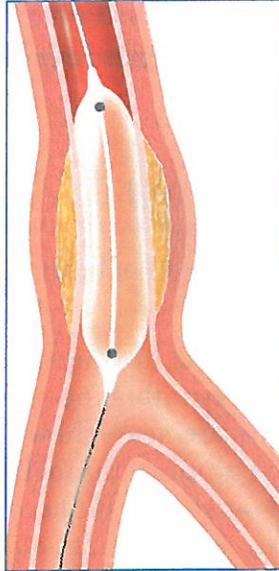


Narrowing in the artery is shown in the circle above.

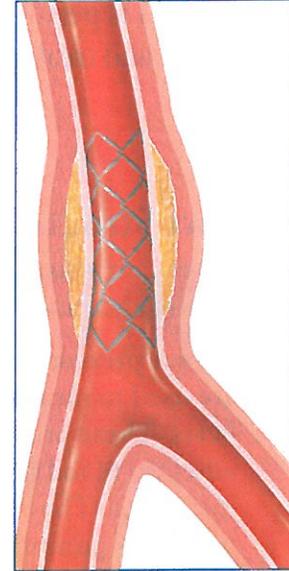
## Procedures to Open Arteries

These procedures are done using catheters and are often performed right after angiography. The most common are:

- **Balloon angioplasty.** The catheter is used to insert a special balloon into the artery. The balloon is inflated and deflated one or more times to open the artery. This is often followed by placement of a stent.
- **Stenting.** A wire mesh tube (stent) is inserted into the artery to hold it open. This device is left in the artery permanently. Your doctor may advise using a **drug-eluting** stent. This is a stent that releases medication over time to help keep scar tissue from forming as the artery heals. This may prevent a new blockage from forming in the same place (restenosis).



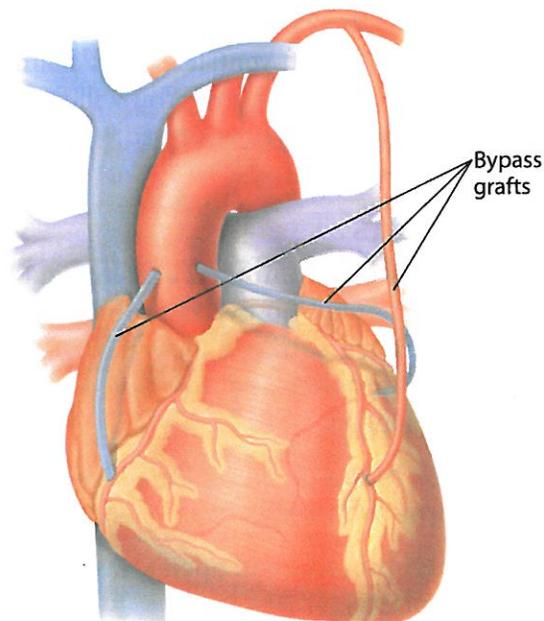
A balloon flattens plaque against the artery walls during balloon angioplasty.



A stent is permanently placed in the artery to hold it open.

## Surgery to Bypass Blockages

Bypass surgery may be advised when blockages can't be opened with angioplasty or when angioplasty is not the best treatment. This surgery will most likely be scheduled at a later date. Bypass surgery creates a new route around the blockages in the arteries. This allows increased blood flow to areas of the heart that haven't been getting enough blood. For this surgery, a blood vessel from the leg, arm, or chest is used to make each bypass.



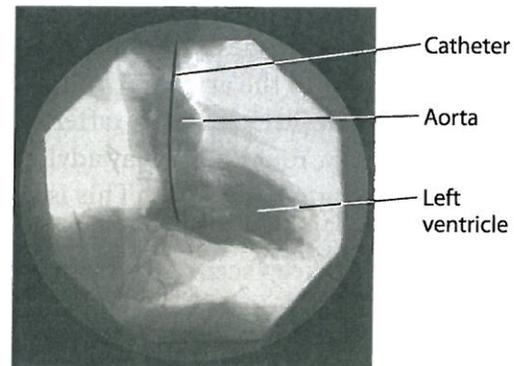
## Diagnosing Heart Structure Problems

With cardiac cath, tests can be done to measure pressures within the heart. If needed, **ventriculography** (x-ray pictures of the left ventricle) is performed. This information helps your doctor evaluate and treat valve and heart muscle problems.

### Heart Structure Tests

Cardiac cath is used to perform tests of heart structure and function:

- **Direct pressure measurement.** Instruments are used to measure pressures within the heart. These pressure measurements show whether blood is flowing properly through the valves. They also show whether the heart muscle is pumping correctly. Both sides of the heart will most likely be tested. For a **right-heart cath**, a catheter is guided through a vein to the right side of the heart. For a **left-heart cath**, a catheter is guided through an artery to the left side of the heart.
- **Ventriculography.** X-ray pictures are taken of the left ventricle, the heart's main pumping chamber. X-ray dye is injected through the catheter into the left ventricle. This chamber then shows up on an x-ray. You will feel a warm flush as the dye is injected.

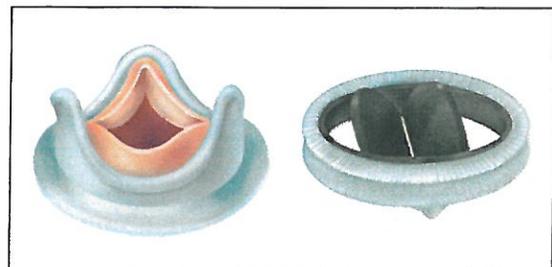


This ventriculogram shows a left ventricle at the start of a contraction.

### Test Results

Your doctor will recommend a treatment plan based on test results. Most valve problems do not need immediate treatment. Depending on the type of heart problem and how severe it is, your doctor may suggest:

- Medication to help control the problem and relieve symptoms.
- A catheter procedure to open a valve (valvuloplasty).
- Surgery to repair or replace a valve.



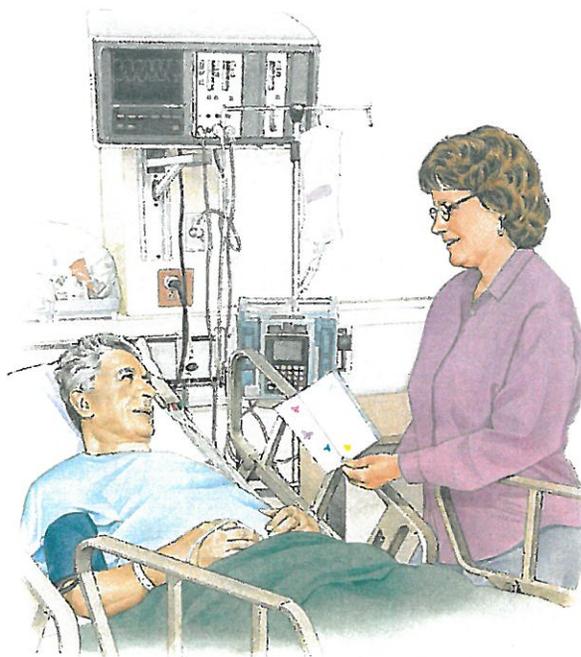
A prosthetic (substitute) valve can be placed in the valve opening and anchored in position.

## After Catheterization

If you only had testing done, you may be able to leave the hospital within 2 to 8 hours. If angioplasty, stenting, or other treatments were performed, you may stay overnight. In either case, you will be sent home once your condition is stable.

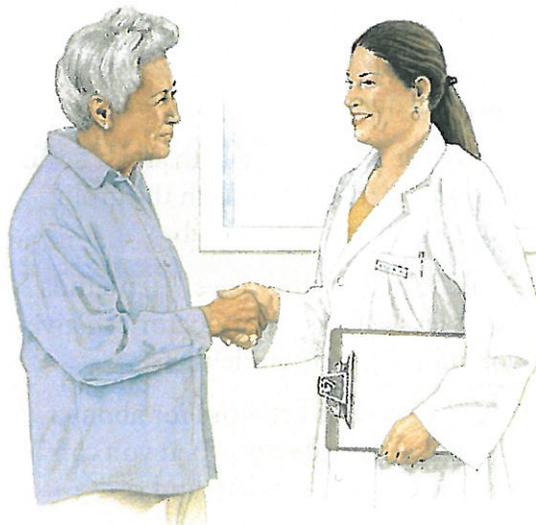
### Closing the Insertion Site

The sheath in your groin, wrist, or arm will be removed, and the insertion site closed. This may be done while you are still in the cath lab. Or, it may be done after you have been moved to a hospital room. You may need to keep still, with your leg or arm straight, for 2 to 6 hours. How long depends partly on the insertion site and the type of closure performed. During this time you may not be able to get up to go to the bathroom. Staff will help you keep comfortable while you rest.



### Monitoring Your Condition

You will be closely monitored until you're ready to go home. Your pulse and blood pressure will be checked often. Be sure to tell the nurse or doctor if you have angina or any other symptoms. The IV line will remain in place until shortly before you leave. Your blood may be tested to assess your condition. You may also have an electrocardiogram (ECG).



### Going Home

You can go home when:

- The insertion site is not bleeding.
- You can urinate.
- Your doctor has reviewed your condition and given his or her okay.

## Recovering at Home

Depending on the procedures done, you may go home the same day or stay overnight. Follow your doctor's instructions on homecare. Depending on the results of the tests, you may need follow-up treatment. Make an appointment with your doctor to discuss the next steps.



### At Home

You can resume most normal activities soon after the procedure. Be sure to:

- Take medications as directed by your doctor. This is crucial to the success of the procedure.
- Shower or take sponge baths for a few days if your insertion site was in the groin. Don't swim or soak in a tub.
- Avoid lifting anything over 10 pounds for at least 3 days. Your doctor can give you more specific guidelines.
- Avoid strenuous activities for about a week. Ask your doctor when you can resume driving, exercise, and sex.
- Talk with your doctor about when you can return to work.

### When to Call Your Doctor

In the 2 weeks after cardiac cath, call your doctor if you notice any of the following:

- The insertion site is increasingly painful, swollen, red, warm to the touch, or is draining.
- The insertion site is bleeding.
- You have fever.
- You have angina.
- You can't urinate, or you have blood in your urine.
- You have severe pain, coldness, or a bluish color in the leg or arm where the catheter was inserted.

## Your Follow-Up

Diagnosing your heart problem is the first step in forming a treatment plan. The goal of this plan is to help you stay healthy and active. After seeing your test results, your doctor may recommend further procedures or surgery. Or you may be able to control your heart problem with medications and lifestyle changes.

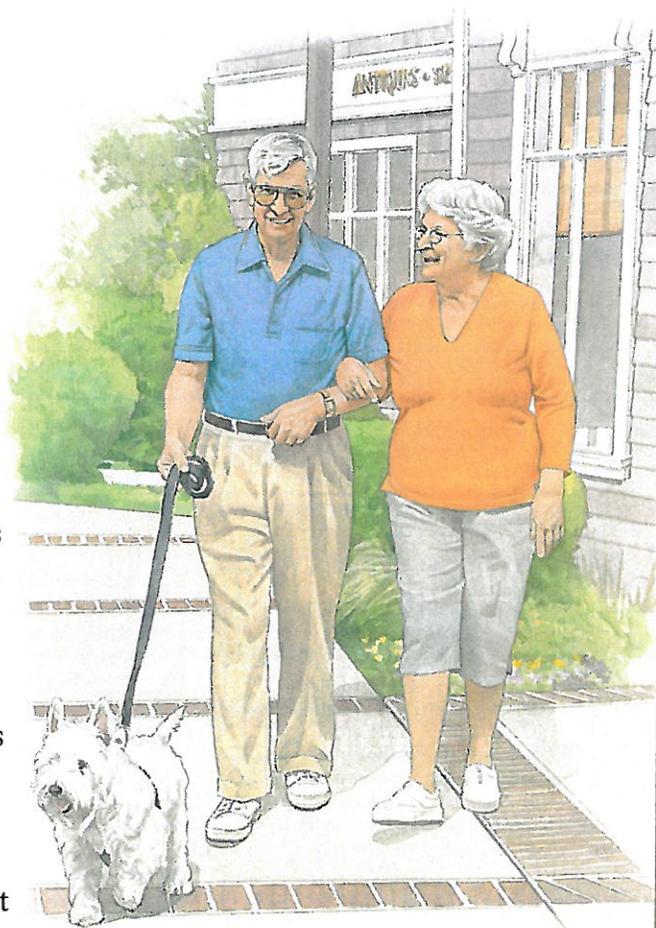
## Procedures and Testing

Your doctor may recommend surgery to correct a valve or artery problem. Or you may need no treatment at this time. In either case, you may need to have blood tests and heart function tests from time to time. Talk with your doctor about what kinds of tests you'll need, and how often.

## Taking Care of Your Heart

Your doctor will most likely prescribe medications for your heart. Depending on the type of heart problem you have, he or she may also suggest lifestyle changes. To take good care of your heart:

- **Take medications as directed.** Medications can help the heart work better and relieve symptoms. Taking them correctly reduces the risk of heart attack or heart failure.
- **If you smoke, quit.** Smoking and other forms of tobacco use harm the blood vessels and heart. Ask your healthcare provider for help in quitting.
- **Exercise.** Frequent moderate exercise can improve fitness. Talk with your doctor about how to exercise safely.
- **Learn to manage related conditions.** Diabetes, high blood pressure, high cholesterol, and obesity can harm your heart health. Your doctor, a dietitian, and other specialists can help you learn how to better control these risk factors.



# Procedure Checklist

Follow any instructions given to you by your doctor. Before the procedure, be sure to:

- Discuss your medications with your doctor.
- Ask your doctor what kinds of treatment may be possible depending on the results of cardiac cath.
- Do not eat or drink after the midnight before the procedure.
- Pack a bag in case you need to stay in the hospital overnight.
- Arrange for a ride home after the procedure.
- Read and sign the consent form.

## Questions for My Doctor:

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