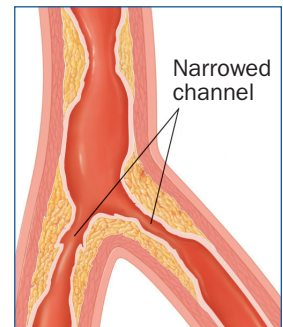


## CORONARY ARTERY DISEASE AND CORONARY BYPASS SURGERY

**The goal of coronary artery bypass grafting (CABG) is to improve blood flow to your heart.**

Your heart is a muscle, about the size of your fist. It pumps blood and oxygen to the organs and tissues of your body through a network of pipes called arteries and veins. Your heart muscle needs oxygen-rich blood to do its job so it feeds some right back to itself. The vessels that feed the heart are called “coronary arteries.” They branch off from your body’s main blood supplier, which is called the “aorta.”



Problems happen when your coronary arteries clog and prevent your heart from getting the blood and oxygen it needs. One way to get around the clog is to make a new path. Surgeons can take healthy veins or arteries from another part of your body and use them to build a new road and “bypass” the clog. CABG can relieve chest pain and improve the quality of your life, especially when combined with a healthy lifestyle.

### YOUR CONDITION

#### What causes clogged arteries?

Healthy arteries are like hollow pipes. When they’re wide open, blood flows through them easily. As we age, these pipes can narrow or clog like the plumbing in your house. These clogs are caused by a buildup of cholesterol, fat and other substances. Narrowing of the arteries is called coronary artery disease (CAD).



Blocked artery

#### Chest pain and heart attacks

When your heart muscle isn’t getting the blood it needs, your body lets you know. Physical or emotional stress may cause you to feel pain or tightness in your chest. This pain is called “angina.” If you’ve felt this, you know that once you rest or take your pills, these feelings usually go away. But angina is NOT a heart attack. Heart attacks happen when part of the heart’s blood supply gets completely cut off and can’t find another route. When this happens, parts of the heart can die and muscle is replaced with scar tissue.

#### How can you tell if you’re having a heart attack and not angina?

The pain of a heart attack can be severe. Some people say it feels like an elephant sitting on their chest. Unlike angina, the pain of a heart attack doesn’t go away after resting or taking medication. By creating clear pathways around the clogs, CABG can help prevent a heart attack and improve your symptoms.

## HEART VALVE DISEASE AND HEART VALVE REPAIR/REPLACEMENT

The goal of this operation is to repair or replace a malfunctioning heart valve so that life-threatening conditions can be prevented from developing later.

### THE HEART

The heart is a muscle that pumps blood through your body. It's divided into four chambers:

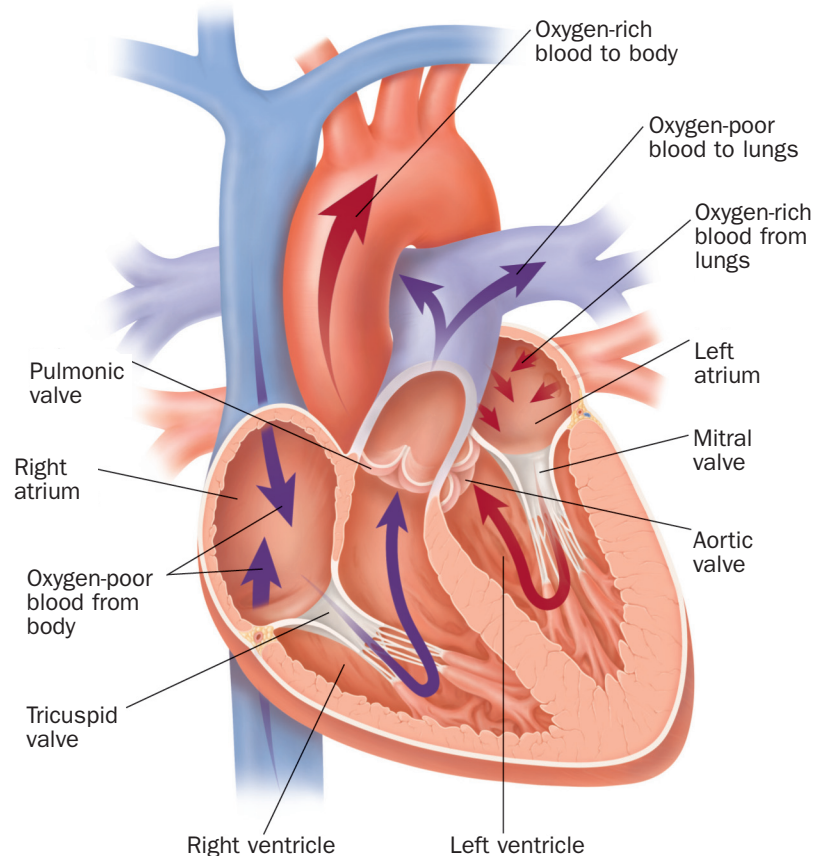
- The chambers on your right side are called the “right atrium” and the “right ventricle.”
- The chambers on your left side are called the “left atrium” and the “left ventricle.”

### WHAT ARE HEART VALVES?

- Valves are one-way gates in the heart that keep blood flowing between the chambers and in the same direction. There are four valves in the heart and each one has strong flaps called “leaflets” that control blood flow.
- Leaflets open to let blood move through the heart and out to the rest of the body. Then they close to keep blood from leaking back in the wrong direction.
- The chambers and valves all work together to keep blood flowing in one direction.

### THIS IS HOW BLOOD TRAVELS THROUGH THE HEART

- Blood fills the right atrium.
- Then it moves into the right ventricle.
- At this point, blood needs oxygen, so it moves from the right ventricle into the lungs where it gets some oxygen.
- Oxygen-rich blood then returns from the lungs and fills the left atrium.
- From here, blood moves through the “mitral valve” and into the left ventricle.
- The left ventricle pumps blood through the “aortic valve” and into the “aorta,” which is the main pipeline for blood leaving the heart.



# ABOUT YOUR HEART SURGERY

- When oxygen-rich blood leaves the aorta, it goes out to feed the body with oxygen.
- After oxygen has been delivered, blood returns to the heart, and the whole process starts again.
- The left side of the heart pumps blood to the entire body, so it has to work a lot harder than the right side. And because the mitral and aortic valves are on the heart's left side, it's usually these valves that have problems.

## YOUR CONDITION

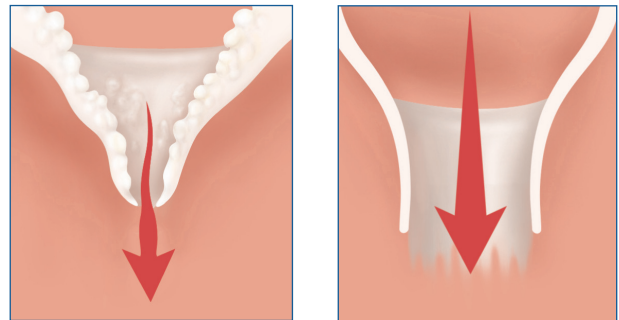
The two most common heart valve conditions are:

- Narrowing (“stenosis”)
- Leakage (“insufficiency” or “regurgitation”)

### NARROWING (STENOSIS)

Stenosis happens most often in the aortic valve. When a healthy aortic valve is open, it's about as big as a half dollar (mitral valves are a little bigger). But sometimes a valve's opening becomes narrow. In many cases, this is caused by the natural wear and tear of aging.

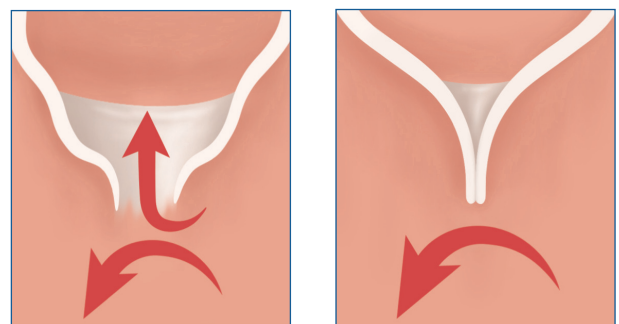
As we get older, calcium can form on the valve's leaflets. As this builds up, the opening can become more narrow, and blood can't flow as easily through the valve.



### LEAKAGE (INSUFFICIENCY OR REGURGITATION)

Leakage happens more often in the mitral valve than the aortic valve. When a valve leaks, the leaflets don't close completely, and some blood leaks backward rather than all of it flowing completely in one direction.

In a healthy heart, blood flows from the left atrium, through the mitral valve, and into the left ventricle. But if there's leakage, some blood flows back into the left atrium instead of out to the rest of the body as it should, and your body doesn't get all the oxygen-rich blood that it needs.



Like stenosis, valve leakage happens because the valve simply wears out as we get older. But other things like a defective valve at birth, or if you had rheumatic fever as a child, can also cause a leak.

# ABOUT YOUR HEART SURGERY

## WHAT HAPPENS TO THE HEART WITH STENOSIS AND LEAKAGE?

Both valve stenosis and leakage make the heart work harder. With stenosis, it has to work harder to pump blood through a narrowed valve. When a valve leaks, the heart has to enlarge and strain so the body gets enough oxygen-rich blood.

All of this extra work can make the walls of the heart thicker or it can cause enlargement of the heart chamber. This prevents the heart from working as it should and over time can lead to serious or even life-threatening problems.

## WHAT YOU MAY FEEL WITH STENOSIS OR A LEAK

You can have valve stenosis or leakage and not even know it or feel a thing. But if your condition becomes more severe, there are a few things you could feel. For instance, you may have:

- Shortness of breath
- Chest pain (“angina”)
- Lightheadedness
- Fainting
- Fatigue
- Your doctor may hear a “whooshing” sound when he listens to your heart (“heart murmur”).
- You could feel a combination of these symptoms or you may not feel anything; it really just depends on your condition.

## ARRHYTHMIA

The heart has its own electrical system, and electrical signals typically fire in rhythm to give the heart a steady beat. An “arrhythmia” is anything that changes this steady beat and makes the heart feel like it’s fluttering or skipping a beat. One of the most common arrhythmias is “atrial fibrillation.”

### Atrial fibrillation

With this, the electrical signals in the atria “short circuit,” or the heart’s upper chambers pump in a fast or irregular way. So in addition to fixing or replacing a valve, your surgeon may treat atrial fibrillation during this operation as well.

## SELECTING A VALVE

If you’re having a valve replaced, a number of factors need to be considered before deciding if you will get a “mechanical valve” or a “tissue valve.” These factors include:

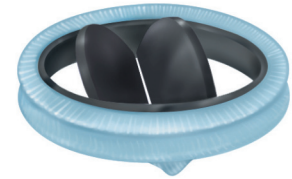
- Your age
- Personal preference
- Other medical conditions

# ABOUT YOUR HEART SURGERY

You and your surgeon will talk about these things to decide which kind of heart valve is right for you.

## **Mechanical valve**

Like a normal valve, mechanical valves have flaps that open and close. They're made of a strong, carbon-based material and a cloth ring.



Mechanical valves are designed to last forever. But the downside to mechanical valves is that blood clots can sometimes form on them. If a clot breaks off, it can enter the bloodstream and block an artery. This can be very serious.

## **Tissue valve**

Tissue valves are often made up of a cloth sewing ring attached to a pig valve, or to three leaflets fashioned from the thin layer of tissue found around a cow's heart (pericardium). Because tissue valves aren't as strong as mechanical valves, they tend to wear out over time. How long before a tissue valve wears out varies; they typically last about 15 years. When a valve finally wears out, another open-heart operation to replace the valve may be needed.



## **BLOOD-THINNING MEDICATION: MECHANICAL VALVE VS. TISSUE VALVE**

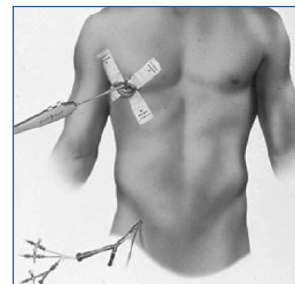
If you get a mechanical valve, you will have to take at least one pill of blood-thinning medication every day to prevent blood clots. You will have to do this for the rest of your life. You will also need to have your blood tested regularly to make sure your medication levels are right.

Blood clots are NOT as common in tissue valves as with mechanical valves. So with tissue valves, you most likely will NOT have to take blood thinners for the rest of your life. You may have to take them for several months after the operation (just until your heart gets used to its new valve).

# ABOUT YOUR HEART SURGERY

## MINIMALLY INVASIVE VALVE SURGERY

For some patients, valve replacement or repair can be performed through a small incision between the ribs. Your surgeon will use special instruments as well as a camera to reach and operate on the heart through a smaller opening called a mini-thoracotomy. This minimally invasive procedure may produce less trauma, less pain and faster recovery than traditional valve surgery.

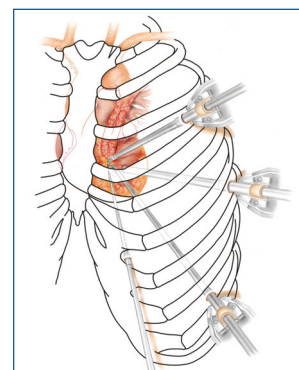


## MINIMALLY INVASIVE BYPASS SURGERY

Patients who need bypass procedures involving one or two vessel grafts may be eligible to undergo minimally invasive direct coronary artery bypass (MIDCAB). The MIDCAB approach allows bypasses to be performed using small incisions on the beating heart. This beating heart bypass is performed using a special stabilization device. MIDCAB may produce less trauma, less pain and faster recovery than traditional open-heart surgery.

## ROBOT-ASSISTED SURGERY

We also perform robot-assisted MIDCAB using the da Vinci® S HD™ Surgical System to work in the chest cavity through a very small incision. During MIDCAB surgery performed with the da Vinci robot, the surgeon's hand movements are seamlessly translated into more precise movements via a set of high-tech instruments and with a steadiness greater than the human hand. With the accompanying high-definition 3D endoscope, surgeons have twice the viewing resolution and 20 percent more viewing area compared with conventional methods.



## BEFORE YOUR SURGERY

### THINK OF YOURSELF AS A KEY MEMBER OF YOUR HEALTHCARE TEAM

Even though you're having surgery on your heart, your surgeon needs to learn about your overall health and your health history. When you give your doctor your important health information, you increase your chance for success. Let your doctor know if:

- You have any other health conditions.
- You're allergic to anything like penicillin or latex.
- You, or anyone in your family, have ever had a bad reaction to anesthesia.
- For your safety, it's important to make a list of everything you take. You may need to get some medications out of your system in the weeks before surgery. This includes: aspirin, anti-inflammatory drugs like Advil™ or Motrin®, blood-thinners like Coumadin® or Plavix®, injections, all prescription and over-the-counter drugs, herbal supplements like Ginkgo biloba, vitamins and recreational drugs.

For a complete list of what to stop taking and when, ask your doctor.

### SMOKING

To help prevent problems during and after the operation, you may need to stop smoking before surgery.

### TESTS

Before your surgery, you will have a number of tests such as an “angiogram” (also called “cardiac catheterization”). An angiogram is a movie of your heart beating that your surgeon uses to see the blockages to plan your surgery. You may also have an echocardiogram, which is a heart ultrasound that shows heart function.

### IF YOU ARE HAVING VALVE SURGERY

If you haven't gone to the dentist in a while, ask your doctor if you should go BEFORE the operation. Why? When you have work done on your teeth and gums, bacteria can enter the bloodstream. If bacteria settles around the new valve, it can cause an infection.

After the operation, you will most likely have to take antibiotics before you visit the dentist or have a medical procedure like a colonoscopy. You may have to do this for the rest of your life.

# ABOUT YOUR HEART SURGERY

## **COMFORT AND SUPPORT**

It's a good idea to ask a family member or a friend to be there with you for comfort and support. Think of this person as your partner in care.

Doctors and nurses prefer to have one "go to" person for all communication. He or she should be able to speak up for you, ask questions, and give information about your health. Be sure to introduce this person to your doctors and your nurses so they know it is acceptable to share your health information with them.

## **THE NIGHT BEFORE SURGERY**

- Do NOT eat or drink anything after midnight.
- If you need to take a pill, take it with a small sip of water.

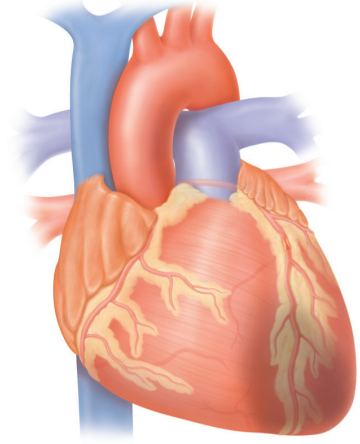
## **THE MORNING OF SURGERY**

You will meet with your anesthesiologist to talk about your anesthesia. As you know, anesthesia is the medicine that puts you into a deep sleep during the procedure.



## CORONARY ARTERY BYPASS GRAFTING (CABG) SURGERY

Surgery begins with a cut through the breastbone or between the ribs (“MIDCAB”). These are then carefully separated and the thin layer of tissue around the heart is opened and folded back. Veins and arteries will be harvested from your leg, arm, or chest, usually through small incisions using a TV camera, to use as your bypass grafts.



- **“On-pump”** CABG is often done by connecting you to a heart-lung machine, which pumps blood for you during the operation. A trained technician closely monitors the heart-lung machine to make sure everything works as it should.
- **“Off-pump”** surgery is selected if your surgeon chooses not to use the heart-lung machine and operates on the heart while it is still beating. Special devices are used to stabilize the heart so the bypasses can be created while the heart is beating.

Please ask your surgeon what is planned for your operation and why.

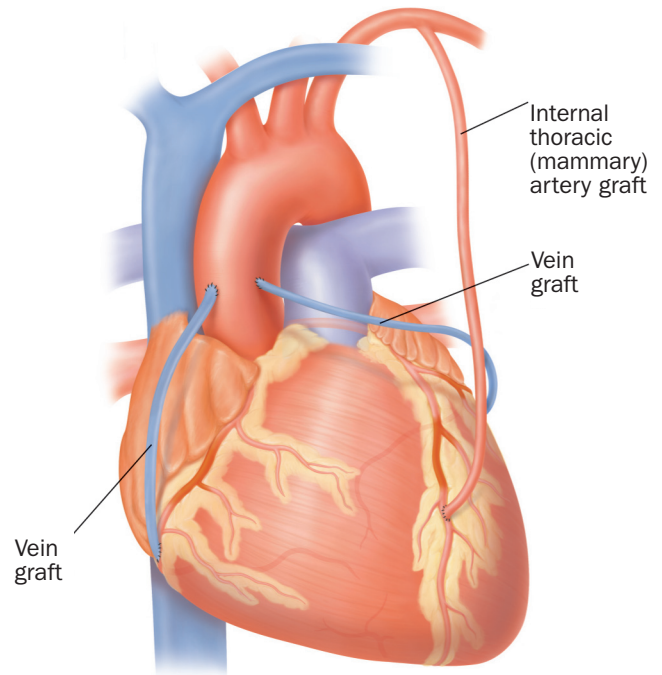
### For Either Bypass Technique

- Your surgeon attaches the bypass grafts above and below the blockage.
- One end of the graft is sewn onto your aorta (your body’s main blood supplier).
- The other end of the graft is sewn past the blockage so blood can flow around the clog.
- Often, the mammary artery from the chest is used as a graft. It remains attached at one end and is grafted onto the coronary artery on the other.

# ABOUT YOUR HEART SURGERY

## Once the Bypasses are Created

- For on-pump surgery, the heart-lung machine is disconnected, and your heart will start to pump on its own. For off-pump surgery, this step is unnecessary.
- Small tubes are placed in your chest to drain any excess fluid.
- Pacing wires may be placed alongside your heart to help it beat normally during your hospital recovery.
- Your breastbone is repaired with wires and your chest is closed. For MIDCAB surgery, the rib space is closed with sutures.
- You will see the drain tubes and pacing wires just below your scar when you wake up. These will be removed in a day or so.



## YOUR PROCEDURE

Your surgeon will go over the specific plan for your procedure and recovery. This will give you a general sense of how surgery will go. The operation can take anywhere from three to five hours.

### BEFORE SURGERY BEGINS

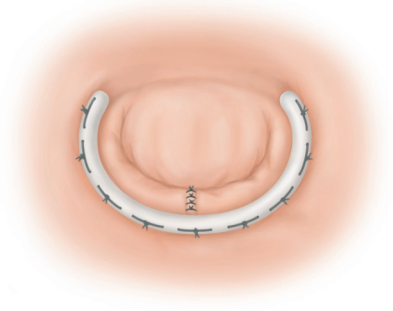
- You will be connected to monitors that measure your blood pressure, heart rate and oxygen in your blood.
- An intravenous line (IV) will be placed in your hand or your arm. This is so you can receive antibiotics, medication and fluids.
- This surgery is done under general anesthesia, which puts you into a deep sleep.
- First, you will receive a sedative through your IV. The medication may sting or burn a little when it goes in, which is normal.
- The anesthesiologist will place an oxygen mask over your mouth and nose and ask you to take deep breaths.
- Very quickly, you will fall asleep. After this, you really won't remember anything about the procedure.
- Once you're asleep, a tube is placed in the back of your throat or down your windpipe to help you breathe.
- Another IV that measures the pressure in your heart may be placed through a vein in your neck.
- A soft tube may also be placed in your bladder to drain urine.

## VALVE SURGERY

- Your surgeon will start by making a cut over the breastbone or between the ribs (minimally invasive surgery).
- Next, the thin layer of tissue that surrounds the heart will be opened.
- To perform this operation, your surgeon will need to temporarily stop your heart. You will be connected to something called a “heart-lung machine.” The machine will do the heart’s job during the operation and keep oxygen-rich blood flowing through your body.
- What your surgeon does next depends on your condition.

### Mitral Valve Repair

- If the mitral valve is causing problems, your surgeon will open the heart to see the valve.
- Then the mitral valve is examined to see how much damage there is.
- If the valve can be fixed, your surgeon may repair it so the leaflets open and close normally.
- Repair usually includes placement of a ring around the valve’s rim to improve its shape and size.
- The valve leaflets may be re-tailored to improve their closing properly.
- Many times, a damaged mitral valve can be repaired. But if your surgeon finds that a valve has too much damage, it may need to be replaced. Replacement is almost always required for aortic valve disease.



### Valve Replacement

For valve replacement, your surgeon will make a cut in the heart or aorta to see the damaged valve.

- Next, the damaged valve is removed.
- The valve opening is then measured so that the right size replacement valve can be selected.
- To attach the new valve, stitches are placed in the valve’s rim.
- The new valve is fitted and stitched to the opening where your valve was located.
- After placing the new valve, your surgeon will stitch the heart or aorta closed.
- If any other heart problems need to be treated, your surgeon may fix those as well. For instance, if you have atrial fibrillation (when electrical signals in your heart go a little haywire), your surgeon may treat it with the Maze procedure.

### Maze Procedure

The Maze procedure treats atrial fibrillation by making thin cuts or burn lines in either of the heart’s upper chambers. Scar tissue forms on the lines.

# ABOUT YOUR HEART SURGERY

Because electrical signals can't travel across scar tissue, the signals are re-routed so they move between the scar lines. This way, the signals move normally between the heart's upper and lower chambers.

## **After Valve Repair/Replacement**

- Your surgeon will allow your heart to beat on its own again.
- The heart-lung machine is then disconnected.
- To help your heart beat normally, "pacing wires" may be placed alongside your heart.
- Your surgeon will also place tubes in your chest to drain fluid.
- The breastbone is then closed with wire, if needed, or the rib space is sutured closed.
- The skin is closed, usually with dissolvable stitches.