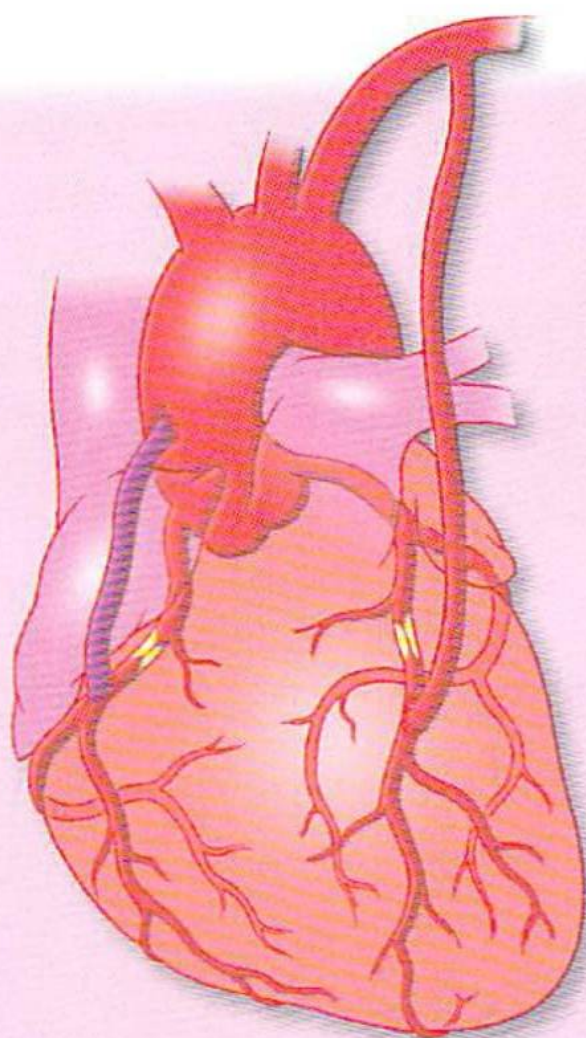



# **Coronary Bypass Surgery**



**A Patient's Guide**

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



Your doctor has recommended that you undergo bypass surgery because fatty deposits have narrowed your coronary arteries (the vessels that supply blood to your heart). Now, you probably have questions and concerns about the operation. This booklet may help answer many of your questions.

### **What Is Bypass Surgery?**

Bypass surgery is an operation in which surgeons create a bypass (detour) to allow blood to go around blockages in the arteries.

To do a bypass, surgeons make a graft using a blood vessel from the leg, chest, or arm. With the graft in place, blood can flow freely around the narrowed or blocked section of the artery to the heart muscle.

### **How You Can Help Yourself**

Most bypass patients recover completely and are able to enjoy many of the same activities they did before surgery. But surgery does not work alone. The health care team needs your help and cooperation. Be sure to follow your doctor's instructions, report symptoms and side effects, and keep a positive attitude.

In addition, you can help prevent the build-up of new fatty deposits in your arteries by making changes in your lifestyle. Enjoy a heart-healthy diet; exercise regularly; and if you smoke—quit.

## How the Heart Works

Before discussing coronary bypass surgery, it helps to understand how the heart works.

### The Heart as a Pump

The heart is a hollow organ that pumps blood throughout the body. It is made up of strong muscle tissue, called **heart muscle**.

The heart has four chambers: two chambers on the left side and two on the right. The upper chamber on each side, called an **atrium**, receives and collects blood. The lower chamber on each side, called a **ventricle**, pumps blood out of the heart.

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

### The Coronary Arteries

In order to keep pumping day after day, the heart needs its own supply of oxygen. The **coronary arteries** are the vessels that carry oxygen-rich blood to the heart muscle.

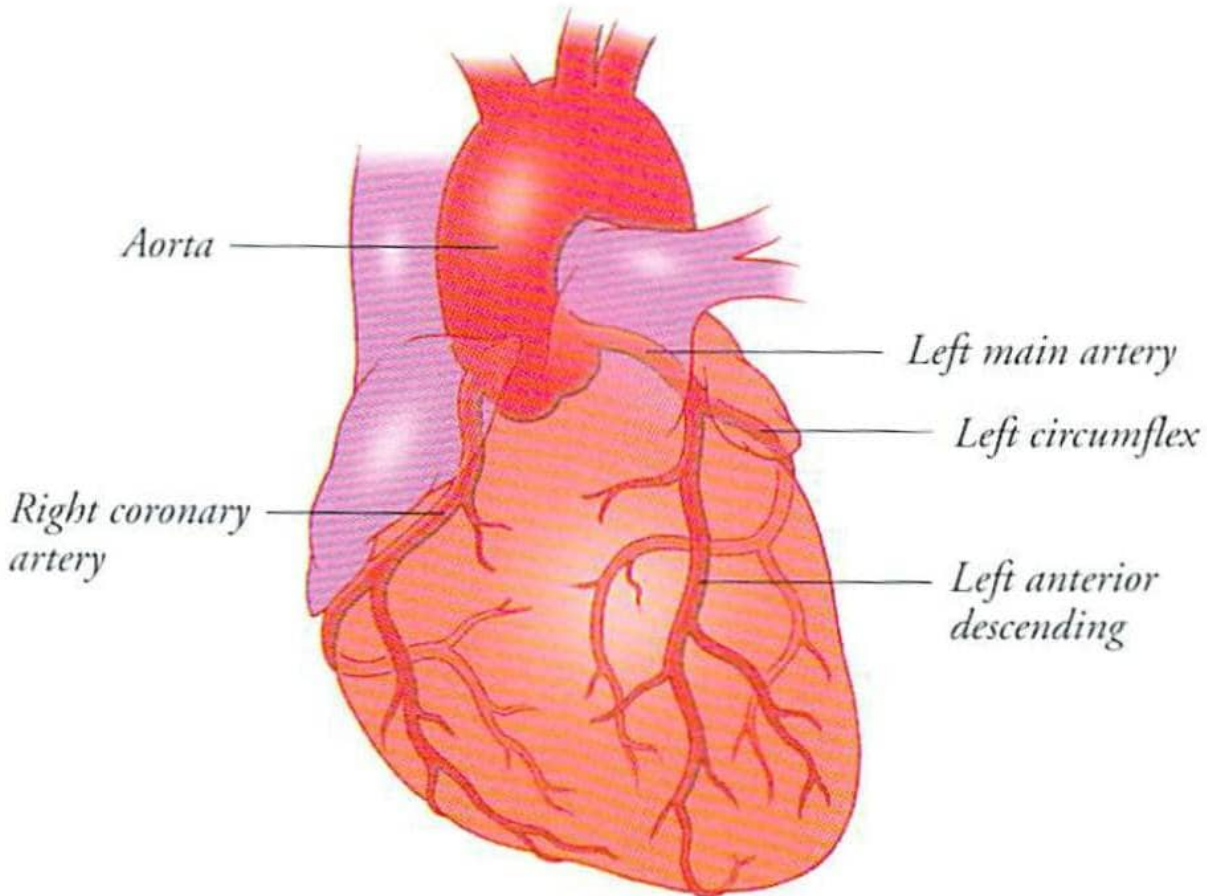
As blood leaves the left ventricle, it is pumped into the **aorta**, the body's main artery. At the beginning of the aorta, near the top of the heart, two coronary arteries emerge. They are referred to as the "left" and "right" coronary arteries.

The first segment of the left coronary artery is called the **left main artery**. It is about as wide as a drinking straw and less than an inch long.

The left main artery then branches into two slightly narrower arteries: the **left anterior descending**, which travels down the front side of the heart; and the **left circumflex**, which circles around the left side and then to the back of the heart.

The **right coronary artery** branches off the aorta, circles around the right side, and then travels to the back of the heart.

The coronary arteries travel on the outer surface of the heart and divide into smaller branches. These branches then penetrate deep into the heart muscle, carrying oxygen-rich blood to all the cells.



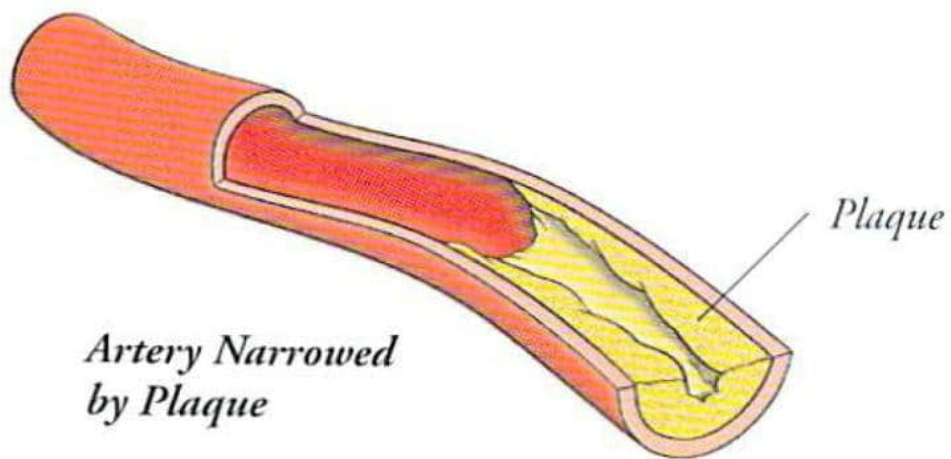
## Why Bypass Surgery?

Generally, bypass surgery is done either to reduce symptoms of coronary heart disease, such as angina, or to help prevent a heart attack.


### Coronary Heart Disease

The inside walls of arteries are normally smooth and flexible, allowing blood to flow through them easily. With time, fatty deposits may build up on the inside of an artery's wall.

As these fatty deposits, known as **plaques**, continue to build up, they narrow the artery and can reduce or even block the flow of blood. Blood flow in the coronary arteries may be reduced enough to cause symptoms of angina, heart attack, or even death.



**Angina** is a pain or discomfort in the chest, arm, or jaw that occurs when not enough blood flows to the heart muscle. It may be a sign that the coronary arteries are narrowed or blocked. Angina typically occurs with exertion or stress, when the heart works harder and needs more oxygen. It generally lasts for only a few minutes and goes away with rest.



Patients with coronary heart disease are at risk of suffering a **heart attack**. A heart attack occurs when a coronary artery becomes totally blocked, usually by a blood clot. The area of the heart muscle fed by that artery dies and turns into scar tissue. A scarred heart may not pump as efficiently as a normal heart.

Coronary heart disease may lead to a number of other heart conditions, such as heart failure (the inability of the heart to pump blood efficiently) and arrhythmias (abnormal heart rhythms). These conditions may cause symptoms such as shortness of breath, fatigue, palpitations, and dizziness.

Keep in mind that *many people with severe coronary heart disease are entirely free of symptoms*. In fact, the first sign of the disease is often a heart attack!

### **Cardiac Catheterization**

If you are a candidate for bypass surgery, you most likely have already undergone cardiac catheterization (also called an angiogram). The procedure allows doctors to assess how well your heart is pumping and take pictures of the coronary arteries.

Although other diagnostic tests also provide valuable information about your heart, cardiac catheterization is the only test that gives an accurate “road map” of the coronary arteries. It shows the surgeon the exact location and severity of the blockages, as well as the areas where bypass grafts can be placed.

## Treatment Options

There are several ways to treat coronary heart disease, including medications, coronary angioplasty, stents, and bypass surgery.

■ **Medications** can help reduce symptoms of angina by increasing the amount of oxygen that reaches the heart muscle and/or reducing the amount of oxygen the heart needs. However, drugs do not remove blockages in the coronary arteries.

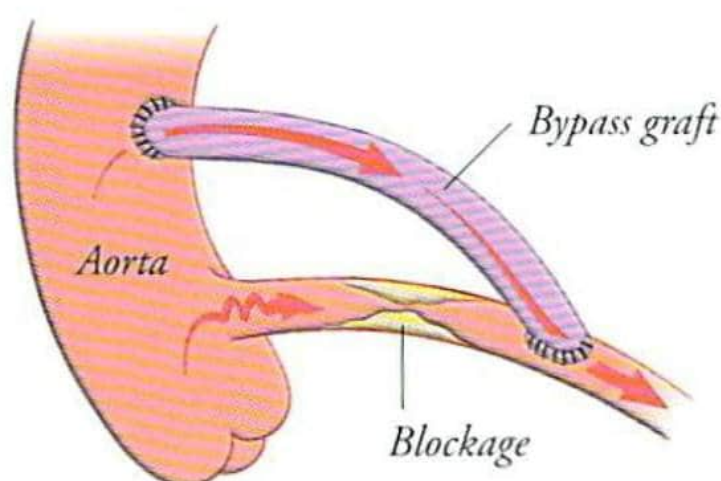
■ **Coronary angioplasty** is a technique used to open narrowed coronary arteries without surgery. During angioplasty, a special catheter with a small balloon at the tip is advanced into the diseased artery. When the balloon is inflated, it stretches the artery and flattens the plaque. This helps improve the flow of blood to the heart muscle.

A small device, called a **stent**, is often placed in the coronary artery at the time of angioplasty to help keep the vessel open. It acts like a tiny metal scaffold that provides support to the artery's walls. The stent is a *permanent* implant that remains in the artery.

Although angioplasty is successful in most cases, it does have some limitations. In particular, the blockage in the artery may recur. Also, in many patients with coronary heart disease, angioplasty may not be an option. This is the case, for example, when an artery is totally blocked or when there are multiple blockages in several coronary arteries.



■ During **bypass surgery**, surgeons use a blood vessel from the leg, chest, or arm to make a **graft**. One end of the graft is attached to the aorta, and the other end is sewn to the diseased coronary artery, beyond the blockage. With the graft in place, blood goes around the narrowed or blocked section of the artery and flows freely to the heart muscle, providing it with oxygen-rich blood.



Bypass surgery requires general anesthesia and usually 4 to 7 days in the hospital. Patients may need up to 3 months to fully recover after this type of surgery.

Bypass grafts tend to stay open for an average of about 10 years. Despite an initially successful surgery, some patients will develop symptoms again. Most often, this is caused by the progression of disease in the coronary arteries. Less often, new fatty deposits build up inside the bypass graft(s).

## **When Is Bypass Surgery Needed?**

If bypass surgery is a likely option, your doctor will discuss the reasons it is needed. In general, bypass surgery may be the preferred treatment if one or more of these conditions exist:


- A blockage in the left main artery (the vessel that supplies the most blood to the heart muscle)
- Severe blockages in 2 or 3 major coronary arteries, especially when the heart is weakened
- Significant symptoms of angina that do not respond to medications and/or cannot be treated with coronary angioplasty

## **What Are the Possible Risks?**

Bypass surgery is major surgery and, in spite of all reasonable precautions, problems can occur. Possible complications may include: lung problems, bleeding, wound infection, abnormal heart rhythms, kidney failure, heart attack, stroke, or death.

Neurologic changes can also occur. These are most often experienced as memory loss and inability to focus. In most cases, such symptoms are temporary.

Factors that may increase the risk during surgery include: a weakened or damaged heart, advanced age, severe obesity, heavy smoking, and serious lung or kidney disease. The risk is also increased during emergency bypass surgery.



Although most patients do not experience major problems, you should know the risks. To learn about *your* particular risk, talk with your doctor.

### **What Are the Potential Benefits?**

The two main goals of bypass surgery are to relieve symptoms of angina and to prolong life.

- The effect of surgery on *relieving symptoms* is often significant. About 90 percent of bypass patients either become free of angina symptoms or have fewer symptoms. Many patients remain totally free of angina symptoms for years.
- The effect of surgery on *prolonging life*, on the other hand, is not as clear-cut. Most experts agree that surgery usually prolongs life in people who have disease of the left main artery or severe blockages in all three major coronary arteries.

## Preparing for Surgery

Unless you are already in the hospital, you'll probably be admitted the day before surgery. Or, you may be asked to check in early on the morning of surgery.

### At the Hospital

Several lab tests will be performed, including blood and urine tests, electrocardiograms (ECGs) that record your heart's electrical activity, and chest x-rays.

One of the doctors involved in your surgery will review your medical history and examine you. (You may be seen by the doctor at the office several days before the operation.)

### BEFORE YOUR ADMISSION

- You may be asked to stop taking aspirin or similar medications (this includes vitamins and herbs) for at least 7 days prior to surgery. Such medications may cause excessive bleeding during or after the operation.
- Continue taking all other medications until reporting to the hospital, unless your doctor tells you otherwise.
- If you smoke, stop now. This will improve blood flow and help your breathing.
- You may want to talk to your doctor about possibly setting aside some of your own blood before surgery. Then, if you need a transfusion, your own blood will be available.



The doctor will explain the operation, its purpose, potential benefits, and possible risks. This is a good time to ask questions and, most important, to share any concerns you may have. You'll then be asked to sign a consent form.

The **anesthesiologist**, the doctor who will keep you asleep and free of pain during surgery, will also talk with you before the procedure.

### **Before Surgery**

You will be asked not to eat or drink anything after midnight the night before surgery. This is to prevent vomiting during the operation. You may be given a sedative on the morning of surgery, and perhaps the night before, to help you relax.

Prior to surgery, your chest, groins, and legs will be shaved. You will be asked to shower and wash your body with an antiseptic soap. Shaving and cleansing helps to avoid infection.

On the day of your operation, you'll be transported to the operating room area on a movable bed.

## The Bypass Operation

Once you have been given anesthetic medications, you will be deeply asleep and unaware of the activity around you. A number of tubes and lines will then be inserted to help you breathe, to drain fluids, and to monitor your condition.

### ■ *Preparing the Grafts*

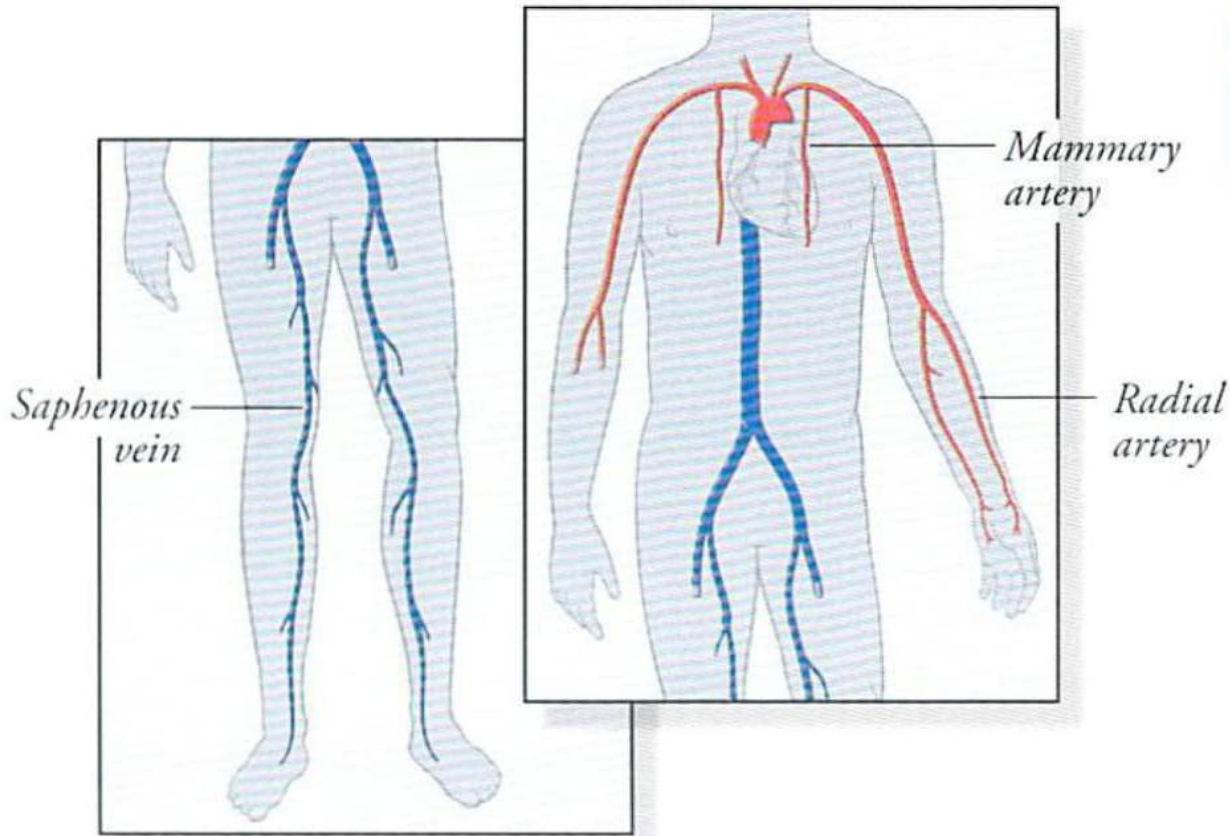
The surgery begins with removal of the blood vessels that will form the bypass grafts. These may be sections of a vein in the leg, an artery from inside the chest or from the arm, or a combination of these.

One vessel used to make grafts is the **saphenous vein** in the leg. One or more incisions are made along the inside of the thigh or calf, and a section of the vein is removed. The vein is not crucial for blood flow in the leg, so it can be removed safely.

Another vessel used to make grafts is the **internal mammary artery**, one of two arteries supplying blood to the inside of the chest. The artery's upper end is left untouched, since it's already attached to a branch of the aorta. The lower end is separated from the chest wall and then used as a graft.

The **radial artery** in the arm is sometimes used to make grafts, although not as frequently as the internal mammary artery. (The hand's blood supply comes from two arteries. If both are clear of plaque, the radial artery can be removed safely and used as a graft).

Generally, arterial grafts tend to stay open longer than vein grafts, so doctors prefer to use arterial grafts.



### ■ *Opening the Chest*

The surgeon makes an incision down the middle of the chest, and the **breastbone** is divided in two. The breastbone's two halves are separated and held open during the operation. The surgeon then exposes the beating heart.

### ■ *Circulating the Blood*

Before the delicate grafting can begin, your heart's action must be stopped. During that time, your blood is passed through a **heart-lung machine** ("pump"). This machine takes over the work of your heart and lungs during surgery, supplying your blood with oxygen and pumping it back through your body.

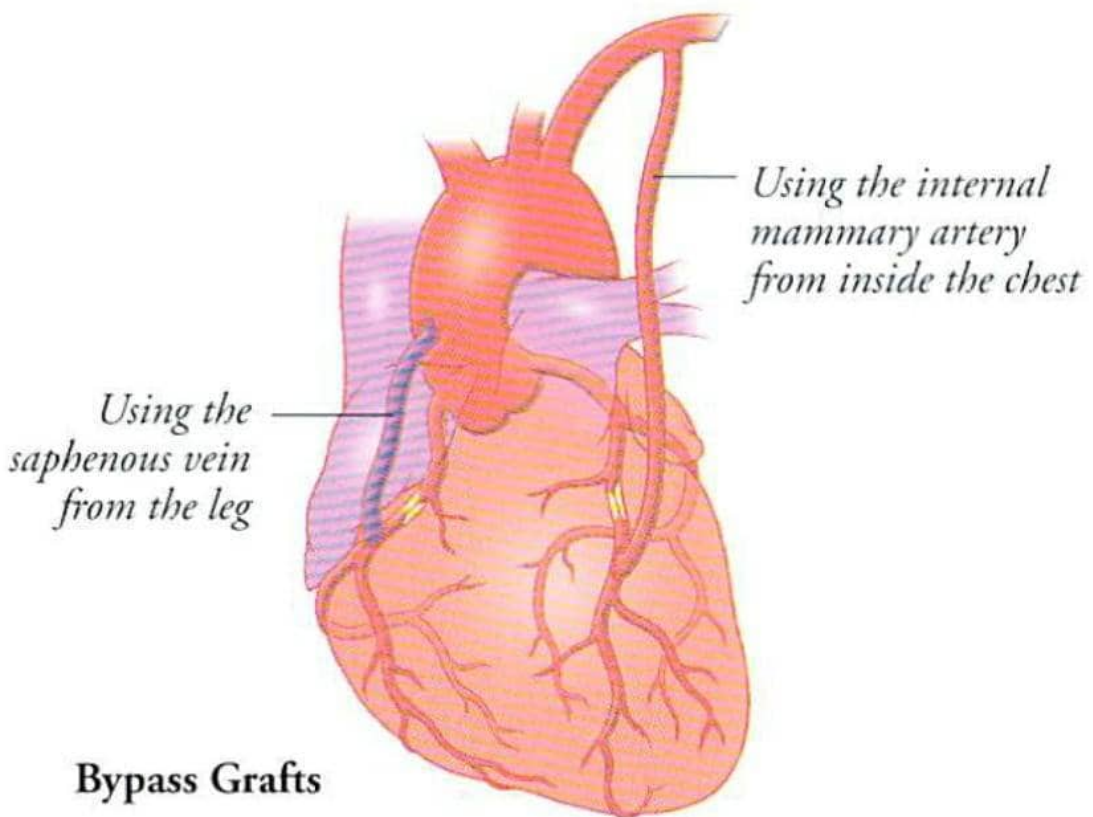
### ■ *Attaching the Grafts*

To attach the graft, the surgeon makes a small opening in the coronary artery beyond the blockage.

If the saphenous vein or radial artery (see page 14) is used to make a graft, one end is sewn, with very fine stitches, to the opening in the coronary artery. The other end is sewn onto the aorta.

If the internal mammary artery (see page 14) is used, one end is already attached to a branch of the aorta. The other end is sewn to the opening in the coronary artery below the blockage.

With the graft in place, blood can flow freely into the coronary artery and to the heart muscle.



**Bypass Grafts**



A graft is attached to each coronary artery that needs to be bypassed. Therefore, you may have “single,” “double,” “triple,” or “quadruple” bypass, depending on the number of arteries or major branches that require a graft.

### ■ *Completing the Surgery*

Once the grafts are securely in place, your heart can start pumping on its own again, and the heart-lung machine is disconnected.

As the surgeons complete the operation, they bring the breastbone back together with several pieces of stainless steel wire. These wires will remain in place permanently, so the bone won't shift when you move about during the healing period. (You won't be able to feel the wires).

The skin is then sutured and covered with a sterile dressing. Stitching may be done with either surgical staples or sutures. The staples or sutures are usually removed within 7 to 10 days. (If *dissolvable* sutures are used, they do not need to be removed, since they dissolve gradually on their own.)

Still deeply asleep, you'll be transferred from the operating table to a movable bed, and then taken to the intensive care unit.

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Bypass surgery generally takes from *3 to 6 hours*, depending on how many arteries are bypassed and how complex the operation is.

## After Your Surgery

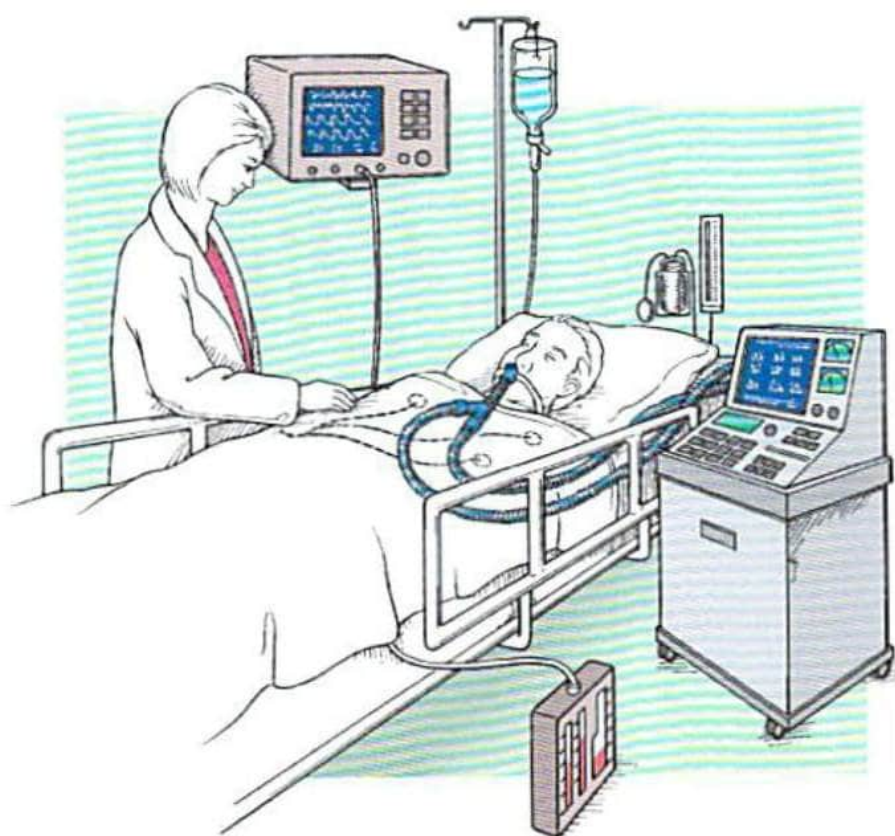
After surgery, you'll be taken to the **intensive care unit (ICU)**, where your condition will be constantly monitored during the early stages of recovery.

### Waking Up in the ICU

When you wake up after surgery, you may feel sore, cold, and perhaps disoriented. These sensations are common, and they won't last long.

You'll notice a variety of tubes and devices that were put in place while you were asleep. These devices help your doctors and nurses observe you closely and care for you during recovery.

- A **heart monitor** continuously records your heart's electrical activity. If an abnormal heart rhythm develops, your nurse can recognize it immediately.
- A **breathing tube** is placed in your throat while you are asleep. The tube is connected to a **ventilator** that helps you breathe during and after surgery.
- **Chest tubes** are inserted during surgery and are used to drain blood and other fluids that tend to build up around the heart. These tubes come through the chest wall and are attached to a drainage device.
- Other tubes and lines may be inserted during or after the operation. These include: **intravenous lines** to give you fluids and drugs; an **arterial catheter** to monitor blood pressure and provide blood samples for lab studies; and a **urinary catheter** to drain the urine from your bladder.



## What to Expect in the ICU

Because the breathing tube passes alongside your vocal cords, you won't be able to talk while it is in place. You'll be able to communicate by making gestures or writing notes. The breathing tube is taken out as soon as you are awake enough to breathe on your own, usually within one day of the operation.

As soon as the breathing tube is removed, you'll be helped to sit up in bed, then get out of bed. You will be shown how to do deep breathing and coughing exercises. The purpose of these exercises is to clear and expand your lungs in order to help prevent lung problems, such as pneumonia.

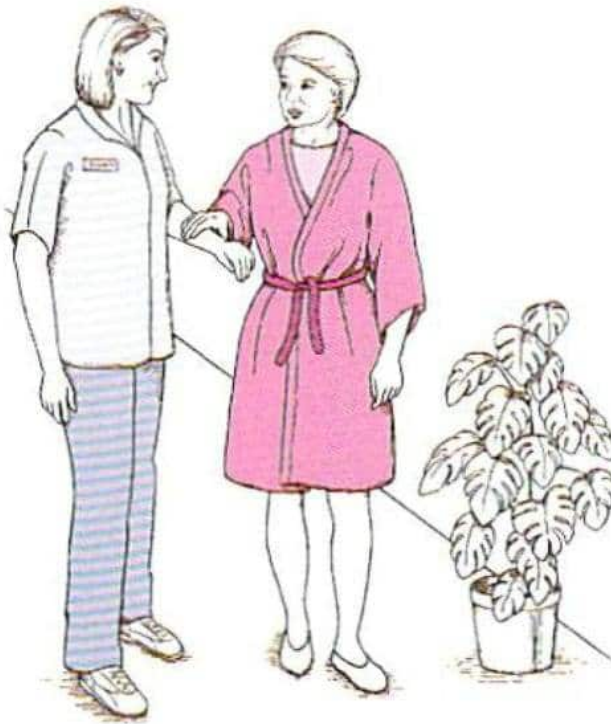
It is common to have some pain after the operation, especially at the incisions. You'll be given medications to relieve pain, whatever its cause.


The tubes and lines that were inserted during the operation will gradually be removed.

### **Moving Out of the ICU**

When you no longer need close monitoring, usually within a couple of days after surgery, you'll be moved to a regular hospital room. You'll still be continually observed for fever, infection of the incision sites, and abnormal heart rhythms.

You will be encouraged to increase your activity levels gradually. As your strength improves, you'll be able to extend the time you spend out of bed and walking.





Your heart rhythm will continue to be monitored during your hospital stay. You will wear a device that monitors your ECG and relays the signals to the nurses' station. If an abnormal rhythm develops, the equipment will alert the nurse.

Your hospital may have a **cardiac rehabilitation program**. A physical therapist (or a nurse) will guide you through daily exercises, such as walking around the unit or climbing stairs. You may receive an exercise plan to follow after you go home.

### **Going Home**

Most bypass patients stay in the hospital for a total of 4 to 7 days after surgery. How long *you* stay will depend on your progress.

Before you leave the hospital, your doctor and nurse will talk with you about medications, the type of foods you can have, and the activities you can safely do at home. Feel free to ask questions.

On the day of discharge, plan your activities so that you get plenty of rest. Ask for pain medication before leaving, if you think you'll need it. Have someone drive you home, and be sure to use your car seat belt.

## Home Recovery

Although not everyone recovers at the same rate, it takes about two months for most people to get back to normal. During that time, it's important to follow your doctor's instructions.

### ■ *Follow-up Visits*

You'll be asked to see your surgeon within a week or two after you leave the hospital. Follow-up visits with your surgeon and cardiologist help ensure that you are recovering safely after surgery.

To monitor your progress, you may have a number of diagnostic tests, such as chest x-rays, blood tests, electrocardiograms, or a treadmill test.

### ■ *Medications*

Your doctor may prescribe one or more medications: to help control your blood pressure, regulate your heart rhythm, lower your cholesterol, prevent blood clots, and/or relieve pain.

- Be sure you understand what each medication is for. If you don't know, ask your doctor.
- Know when and how often you should take each medicine. Try to take it at the same time or times each day.
- If you think you are having a side effect, call your doctor. Do not just stop treatment!
- Even if you start to feel better, do not stop taking your medications or change the dosage unless your doctor tells you to.

## WHEN TO CALL YOUR DOCTOR

You should call your doctor if you notice any of these warning signs:

- Increased redness, swelling, or pain around your incision sites, or yellowish drainage from the incisions (see also pages 24-25).
- Significant fever (over 100°F) or fever that persists for more than three days (even if less than 100°F). Shaking chills.
- Significant shortness of breath while resting or during minimal activity.
- Excessive swelling in your feet, ankles, and legs. Weight gain of 2 or 3 pounds in one day or 5 pounds in one week.
- Excessive or persistent fatigue.
- Pain or discomfort in the chest, arm, or jaw that becomes more frequent, more severe, or that occurs with minimal activity.
- Chest pain that is worse with coughing or deep breathing. Persistent cough.
- Palpitations (pounding in the chest). Dizzy or fainting spells. A heart rhythm that is too fast, too slow, or irregular.
- Any symptoms that you are experiencing and are concerned about.

### ■ *Surgical Incisions*

In general, the breastbone heals in about 6 to 8 weeks, while incisions in the thigh or calf take about 3 to 4 weeks to heal. During that period, the incisions may feel sore, numb, or itchy.

Some patients develop inflammation, marked by redness, swelling, and pain at the incision site. This usually goes away within a few days.

Occasionally, an incision becomes infected, resulting in increased redness, soreness, and drainage of pus. If this occurs, notify your doctor. An infected incision may require treatment with antibiotics.

A low-grade fever is fairly common during the first few weeks at home. If your fever is over 100°F, if it persists, or if you develop shaking chills, this may be a sign of infection. Let your doctor know.

### ■ *Driving*

Generally, driving is not permitted for about 6 weeks; you may ride as a passenger in a car at any time, however. Driving is temporarily restricted for two main reasons: to protect your breastbone as it heals, and to allow your reflexes (slowed after surgery) to return to normal.

Drive only when you have recovered full coordination and are experiencing little pain. Do not drive after taking pain medication. *And always use seat belts!*



## CARING FOR YOUR INCISIONS

- You will probably be permitted to shower at home. Wash your incisions gently with warm (not hot) water and mild soap, then pat them dry with a towel. Do not scrub the incisions.
- Do not apply lotions, creams, or powders to the incisions until healing is complete and scabs have come off.
- If strips of tape were placed on your incisions in the hospital, you may gently remove them as they loosen, about a week after going home.
- It is fairly common for the leg from which the vein was removed to swell. Your doctor may recommend surgical stockings that support the leg and reduce swelling. Put the stockings on in the morning and remove them at bedtime.
- Also, to help prevent swelling, elevate the leg above hip level as often as possible. When sitting, place the leg on a chair that is facing you. Or lie down flat, several times a day, with the leg supported on a couple of pillows.
- Call your doctor if you develop problems at your incision sites, such as increased redness, soreness, swelling, or drainage.

### ■ *Your Activity Program*

Before you leave the hospital, your doctor or nurse will tell you what types of activities you can do at home. Your activity program will depend on several factors, including your medical condition, the stage of your recovery, and your fitness level.

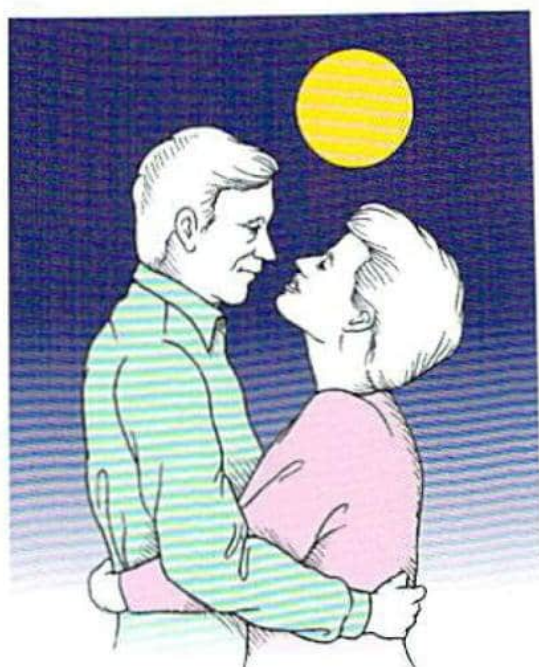
Walking is the best form of exercise during the early stages of recovery. It's likely you will be advised to walk on flat ground once or twice a day, for a total of 20 to 30 minutes each day.

Gradually, you may take longer walks. By 6 weeks, you should be walking for 40 to 60 minutes each day, over a distance of 2 to 3 miles.



## THE FIRST FEW WEEKS

- You may feel tired during the first few weeks after your surgery. Little by little, you'll gain more energy and strength.
- Increase your activities gradually. Slow down or stop when you feel tired. Get enough sleep at night.
- Light walking is a good activity during early recovery. Avoid walking uphill, against a cold wind, or on hot and humid days.
- Remember that it takes 6 to 8 weeks for the breastbone to heal. Avoid putting too much strain on it during the healing process.
- Avoid lifting more than 10 pounds for the first 6 weeks. This includes carrying children, pets, groceries, suitcases, etc.
- For the first few weeks, do light housework only, such as preparing meals, washing dishes, and dusting. Avoid vacuuming, gardening, and mowing the lawn.
- For recreation, you may participate in card games, board games, and arts and crafts. Avoid golf, tennis, and bowling.
- Ask your doctor before making travel plans. Travel should be leisurely and relaxed. Do not carry heavy luggage.




### ■ *Sexual Relations*

Difficulties in sexual relations after heart surgery are often due to poor communication between partners. It is important that you openly discuss your fears and concerns with each other.

You may resume sexual relations when you feel physically comfortable, usually about 2 to 3 weeks after you leave the hospital.

Choose positions that require less effort and put less strain on the breastbone, such as lying side-by-side or active partner on top. Try to avoid supporting your body weight on your arms.

Stop sexual activity if you begin to experience chest pain or discomfort, shortness of breath, palpitations, or dizziness. Wait for the symptoms to go away before you resume activity. Let your doctor know if the symptoms recur.



### ■ *Your Emotions*

Recovering from bypass surgery is an emotional as well as a physical process. The stress of surgery, lack of sleep, and medications can all have an effect on your emotions.

You may have days during your recovery when you feel discouraged, frustrated, or even depressed. This is normal after any major surgery. Remember that these feelings are only temporary and that emotional healing will take place.

You can help yourself get through such bad days by talking out your problems with a loved one or by engaging in activities that you enjoy. If the problems don't seem to go away, talk with your doctor.

### ■ *Cardiac Rehab Program*

Your doctor may refer you to an outpatient cardiac rehabilitation (cardiac rehab) program. The program is designed to help patients who have had a heart attack or heart surgery recover and get back to normal more quickly. The program consists of monitored exercise sessions, education, and counseling.

### ■ *Returning to Work*

If you have a desk job, you should be able to go back to work in 4 to 6 weeks after surgery. If you have a physically strenuous job, you may need to wait 6 to 8 weeks, or longer. Your doctor will tell you when it is all right for you to return to work.

## Changes in Your Lifestyle


Certain conditions and habits, called **risk factors**, can lead to further build-up of fatty deposits in your coronary arteries and bypass grafts. By changing your lifestyle, you can help bring these factors under control and get the most out of your surgery.

### ■ *Enjoy a Heart-Healthy Diet*

A diet high in saturated fats and cholesterol tends to raise your blood cholesterol level. Excess cholesterol in the blood tends to build up on the walls of arteries and can lead to heart disease.

You can help lower your cholesterol level by changing the kind of foods you eat.

- Cut down on fat, especially saturated fats. Foods that contain a lot of saturated fats include fatty cuts of meat, sausage, whole milk, cream, and cheese.
- Choose foods that are rich in starch and fiber, such as whole grains, cereals, pasta and rice, dried beans and peas, and fresh fruits and vegetables.
- When you go grocery shopping, choose fresh fruits and vegetables, whole-grain bread, cereals, low-fat dairy products, fish, chicken, and lean cuts of meat.
- Use cooking methods that need little or no fat, such as steaming, baking, broiling, and grilling. Trim off all visible fat before cooking your meat.
- Lose extra weight. Eat a variety of nutritious, low-fat foods, and go easy on high-calorie items (such as snacks, pastries, desserts, and fatty cuts of meat). Eat smaller portions of all foods.



### ■ *Exercise Regularly*

About 2 to 3 months after your bypass surgery, you may be ready to add more strenuous exercise to your routine. Consult your doctor first.

Regular exercise strengthens the heart muscle and helps the heart and lungs use oxygen more efficiently. It also helps you control blood pressure, lose weight, and reduce stress and tension.

To benefit your heart, you should exercise at a level that is appropriate for you, for a period of 30 to 60 minutes, 3 to 4 times a week.

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

### ■ *If You Smoke—Quit!*

People who smoke have more than twice the risk of having a heart attack than those who do not smoke.

If you have not been able to stop smoking on your own, you may want to join a smoking-cessation program. You'll be given brochures, audio tapes, and kits that will assist you in quitting.

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Making these changes in your lifestyle and following your doctor's instructions are essential for getting the most long-term benefit from your surgery.

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