

Heart Failure



what you should know

Vital information about:

- heart failure
- cardiac risk factors
- lifestyle modification
- treatment options

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Treatment Disclaimer

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Introduction

Heart failure (HF) is the fastest growing form of cardiovascular disease in the United States. One in 5 adults over age 40 will develop HF in his or her lifetime.

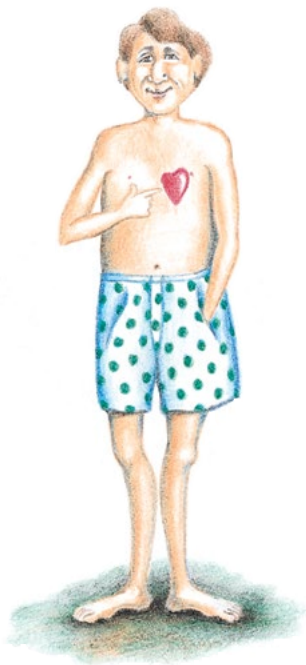
This book defines HF. It reviews some of the risk factors and explores possible treatment options. HF patients play a central role in the management of their disease. People can live full and active lives with HF; it is really not “failure” but dysfunction.

It may be easier for you to understand HF and how it develops once you understand how the heart works.

Follow along. We'll start slowly.

Greg and Dean

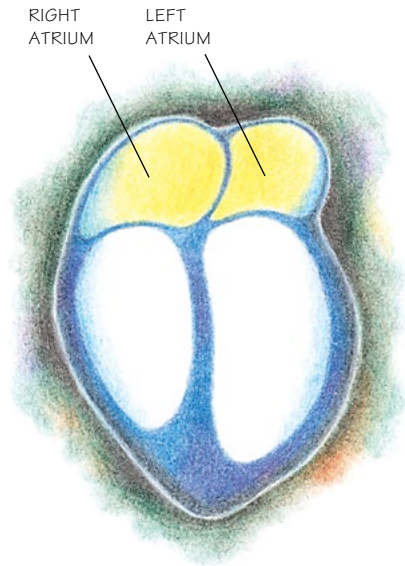
Heart Anatomy



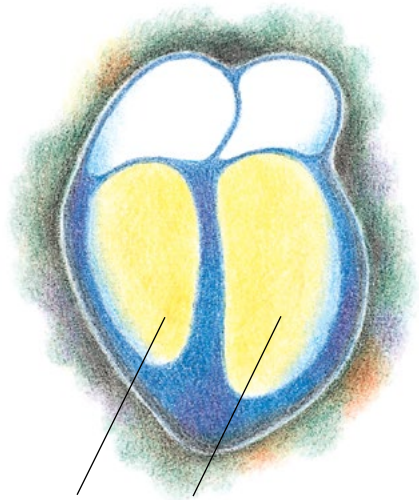
The heart

The heart is a muscle.
It pumps blood to the
head and the body.

It is about the size of
your fist and sits just
to the left of the middle
of your chest.



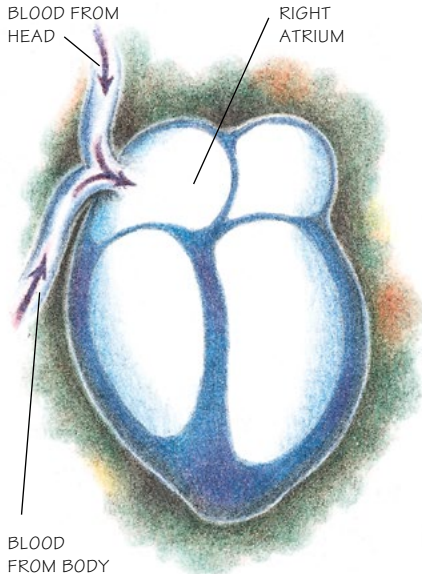
The heart is made up of 4 chambers. The top 2 chambers are called the **atria**. The atria collect blood returning to the heart from the body and lungs. The atria then dump the blood into the ventricles.



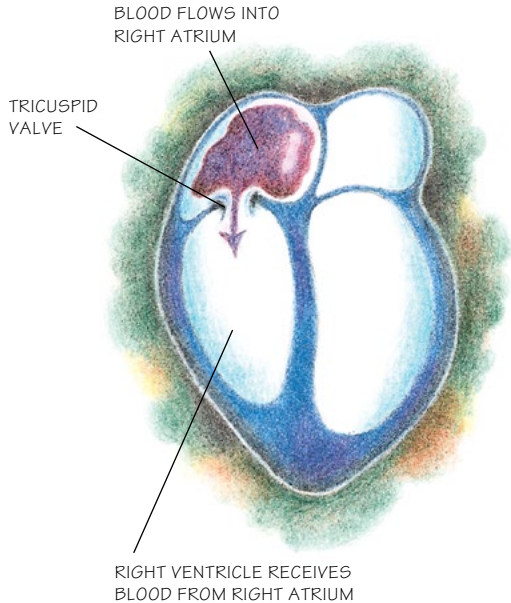
RIGHT
VENTRICLE

LEFT
VENTRICLE

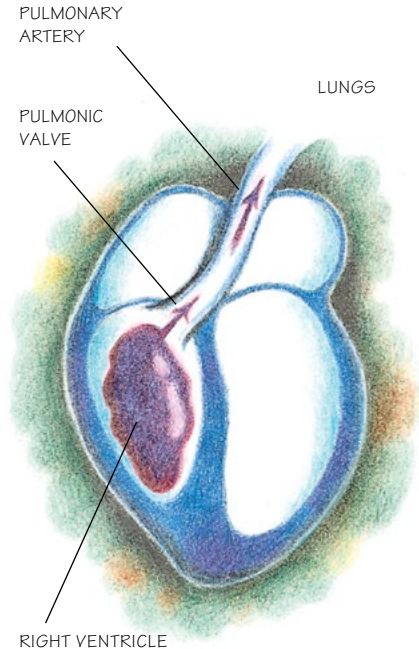
The bottom 2 chambers are called the **ventricles**. The ventricles are larger than the atria, and the left one is more muscular. When the ventricles contract, they propel blood out of the heart to different parts of the body.



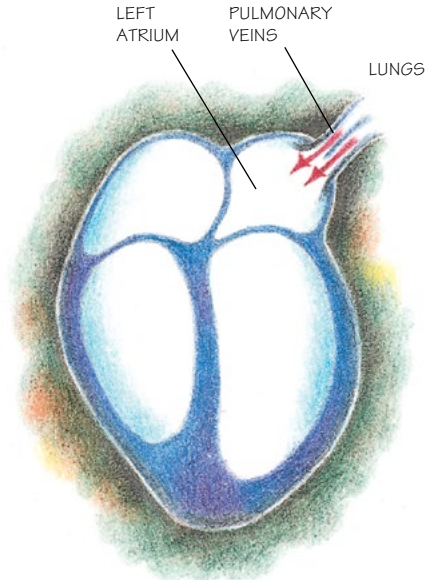
The body uses nutrients and oxygen carried by the blood. The blood returning to the heart from the body has had oxygen removed. This “deoxygenated” blood collects in the **right atrium**.



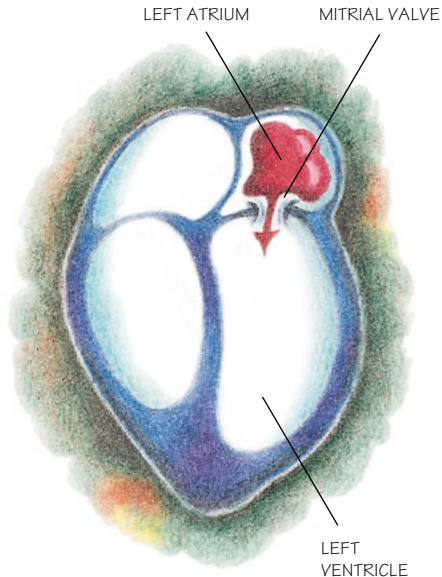
The blood in the **right atrium** goes through the **tricuspid valve** (one-way valve) and goes into the **right ventricle**.



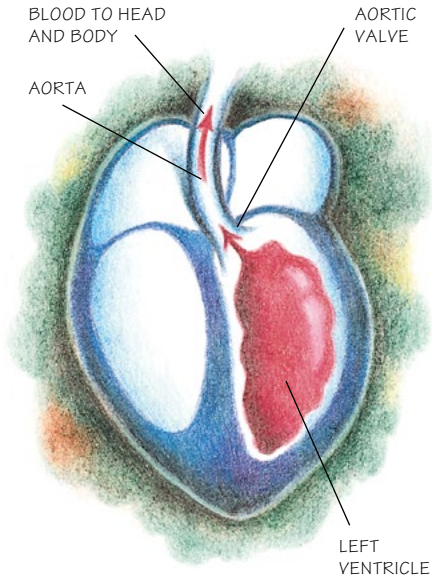
The **tricuspid valve** then closes. The **right ventricle** contracts and pumps blood through the **pulmonic valve**. The blood travels through the **pulmonary artery** to the **lungs** where it picks up oxygen.



The “oxygenated” blood returns to the heart through the **pulmonary veins** and collects inside the **left atrium**. The oxygen-rich blood is ready to be used by the body again.



The blood in the **left atrium** travels through the **mitral valve** (one-way valve) and into the **left ventricle**.



The **mitral valve** then closes. The **left ventricle** contracts and pumps oxygenated blood through the **aortic valve** into the **aorta**. The blood then travels through the **aorta**, providing life-sustaining oxygen and nutrients to the body.

So:

- 1) Blood with lower oxygen content collects in the right atrium.
- 2) The right ventricle pumps blood to the lungs where it picks up oxygen.
- 3) Oxygen-rich blood returns to the left atrium from the lungs.
- 4) The left ventricle pumps oxygen-rich blood to the head and the rest of the body.

Heart failure (HF) is a condition in which the pumping function of the heart is impaired and cannot meet the demands of the body. The term “failure” can be misleading as it indicates the heart cannot recover or the heart is not working. In truth, heart failure is more akin to “heart dysfunction,” which can be treated in many *different* ways so that the heart can heal and improve. Often, with treatment, the symptoms resolve and patients can live full and active lives.

To understand HF, it is often best to discuss the symptoms. These fall into 2 broad categories: (1) congestion or fluid backing up in the circulatory system and (2) low cardiac output or poor forward flow.

Symptoms of congestion

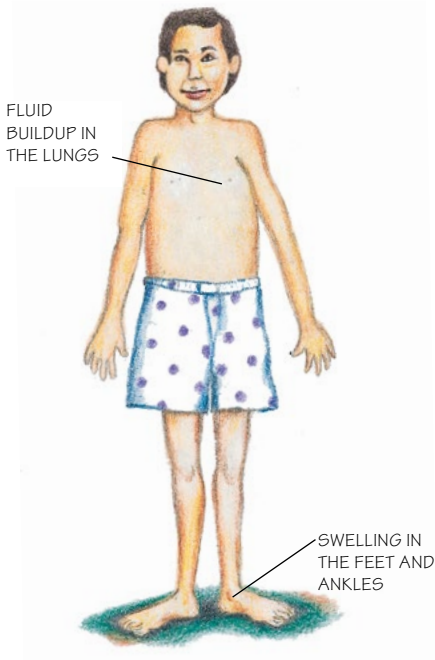
- 1) Shortness of breath, noted at first during physical exertion. If the disease progresses, shortness of breath may occur even when resting.
- 2) Waking from sleep due to shortness of breath or inability to lie flat
- 3) Cough producing clear or white sputum
- 4) Swelling in the legs and feet as well as weight gain due to fluid “buildup” or retention (sometimes called **edema**)

How does congestion occur?

Imagine for a moment that you are sitting in rush-hour traffic. Everyone is trying to use the same road at the same time. There just is not enough room to handle all the cars. So, what happens? Traffic becomes backed up.

That is very similar to what happens in the body with heart failure.

Because the heart's ability to pump blood is impaired, it cannot keep up with all the blood returning from the body. The amount of blood and the pressures within the heart chambers increase. This blood backs up in the heart and the rest of the body, causing a buildup of fluid in the tissues.



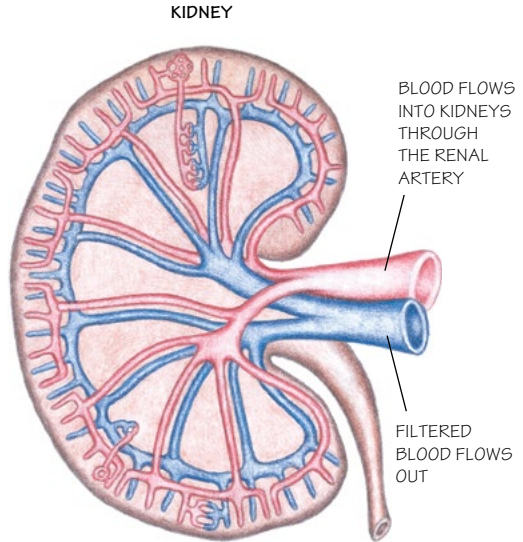
Fluid congestion in the tissues (**edema**) usually results in swelling of the legs and ankles. Fluid buildup in the lungs (**pulmonary edema**) results in difficulty breathing, especially when lying down.

Symptoms of poor forward flow

- 1) Fatigue
- 2) Lightheadedness
- 3) Nausea and lack of appetite

When HF is more *advanced*, other organs in the body do not receive the oxygenated blood that they need. As a result, their function becomes impaired as well.

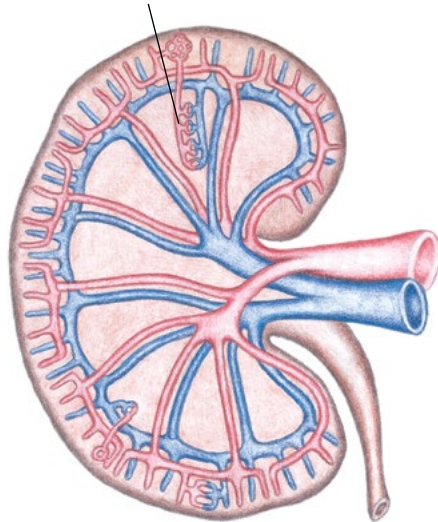
The heart delivers blood to all vital organs, including the kidneys. The kidneys play an important role in regulating blood pressure and fluid retention. The kidneys act like a water filter for your blood. Blood flows through the kidneys so that impurities can be removed.



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The amount of blood received by the kidneys varies in direct proportion to the amount of blood pumped by the heart. When the heart pumps less blood, the kidneys feel “starved” and retain sodium (found in salt) and water, resulting in fluid retention.

SALT AND WATER ARE REABSORBED IN THE KIDNEYS



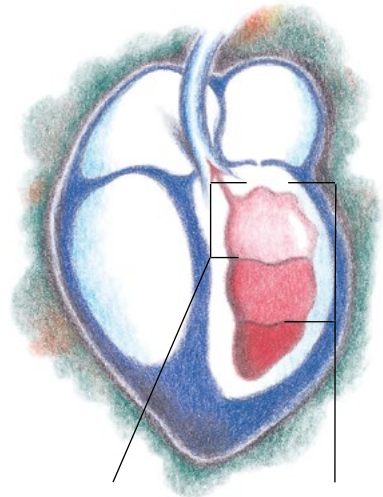
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Classifying heart failure

There are 2 categories of heart failure. The classifications are based on the amount of blood pumped out of the left ventricle (**ejection fraction** or **EF**). The 2 categories are (1) HF with **reduced** EF (HFrEF) and (2) HF with **preserved** EF (HFpEF). The difference is important because it determines the types of medications and devices that can treat these conditions. Before we discuss these treatments, let's discuss how the EF is measured.

Ejection fraction

The ejection fraction (EF) is the amount of blood that is pumped out of the left ventricle with each beat of the heart. The normal range for ejection fraction is 55% to 70% of the blood pumped out with each beat.



EJECTION FRACTION
FOR SOMEONE WITH
HEART FAILURE

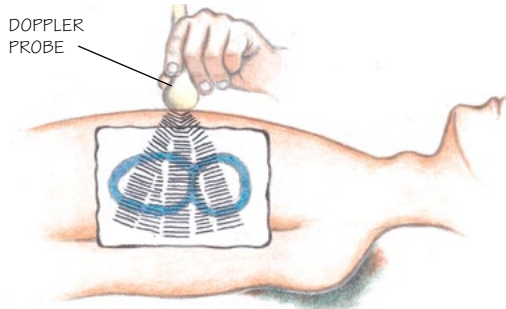
NORMAL
EJECTION
FRACTION

The **ejection fraction** of the **left ventricle** is usually determined by 1 of 4 tests:

- 1) Echocardiogram (Echo)
- 2) Cardiac MRI
- 3) Heart catheterization (LV gram) or
- 4) Nuclear scan (SPECT)

1. Echocardiogram (Echo)

A sound-wave probe is held against the outside of the chest. The probe uses an ultrasound (similar to a sonogram) to create moving images of the heart. The test can also give important information about the function of heart valves.

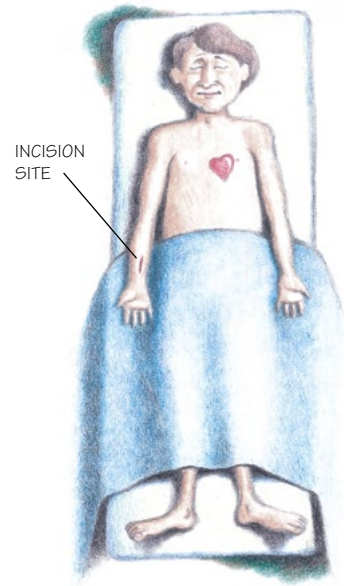


2. Cardiac MRI

MRIs are special machines that can take detailed pictures of the body. This test can very accurately measure the ejection fraction. Cardiologists also can obtain unique information about the disease process involving the heart muscles such as the presence of scar tissue or inflammation. Sometimes people cannot undergo MRIs due to the presence of metal in their bodies or from fear of being in tight spaces (claustrophobia).

3. Heart catheterization (LV gram)

Left ventriculogram (LV gram) is obtained during a heart catheterization. A thin tube called a catheter is inserted into the right wrist artery or a vein in the groin and pushed up into the heart. Angiographic contrast, or dye, is injected through the catheter into the left ventricle so that the function of the left ventricle can be observed directly.



4. Nuclear scan (SPECT)

Nuclear dye is injected into the blood. X-ray pictures are taken to determine how much dye is being pumped out of the heart during each beat. This test does not require a catheter to be inserted into the heart.

Here's a quick summary.

- 1) The amount of blood pumped out of the **left ventricle** is called the **ejection fraction**. A normal ejection fraction is about 55% to 70%. People can have HF with either normal (preserved) EF as well as with a reduced EF (usually less than 40%).
- 2) The symptoms of HF occur when blood backs up in the circulation causing congestion of the organs (lungs, legs, abdominal organs) and when not enough oxygenated blood is pumped forward.

Risk Factors

What conditions lead to HF?

Many different cardiovascular conditions can result in HF. Often these conditions are treated successfully for years before the symptoms of HF develop.

The primary risk factors for HF include:

1. Poorly controlled hypertension
2. Coronary artery disease and heart attacks
3. Diabetes and obesity
4. Diseases of the heart valves
5. Heart rhythm abnormalities including atrial fibrillations
6. Infections
7. Toxins such as certain types of chemotherapy and alcohol

1. Poorly controlled hypertension

Hypertension is commonly referred to as high blood pressure. If you have a **systolic pressure** greater than 120 mm Hg and/or a **diastolic pressure** greater than 80 mm Hg on 2 separate visits to the doctor, then you may have high blood pressure.

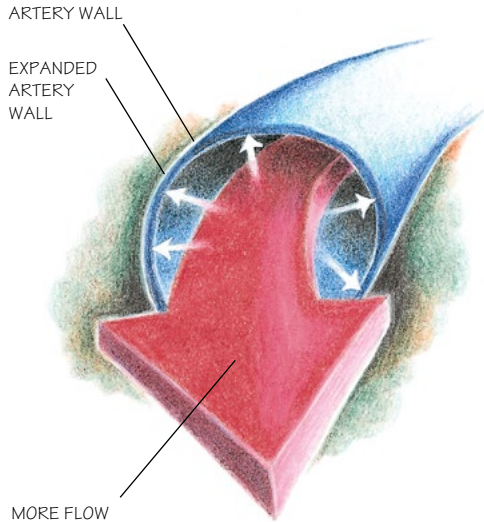
SYSTOLIC
NUMBER

120

80

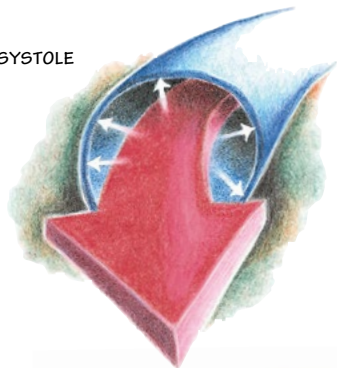
DIASTOLIC
NUMBER

SYSTOLE

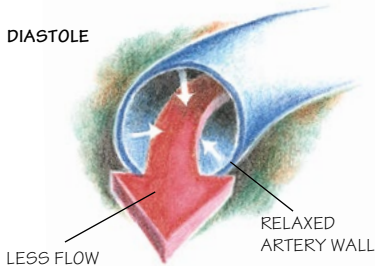


What is **systolic pressure**? Blood comes out of the heart in 1 big thrust. The artery expands to handle the blood. The amount of pressure put on the expanded artery wall is called **systolic pressure**.

SYSTOLE



DIASTOLE



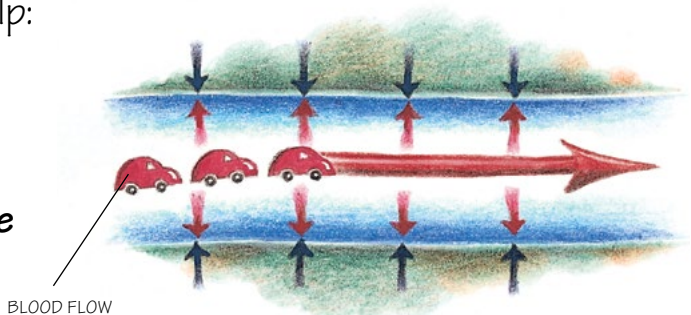
After the artery expands during systole, it relaxes back to its normal size.

It is similar to a rubber band that goes back to its normal shape after being stretched. Normal pressure on the artery wall during relaxation is called **diastolic pressure**.

How does hypertension relate to cardiovascular disease?

Blood pressure is a result of the blood flowing through the artery (cardiac output) and the resistance of the artery wall (vascular resistance). If that sounds too technical, here... this may help:

**Blood pressure =
Cardiac output x
vascular resistance**



If a lot of resistance is created by either the blood or the artery wall, then there is more pressure as the blood travels through the artery. If it takes more energy to get blood through the arteries, then your heart has to work harder with each beat. Most people with high blood pressure do not realize they have it. No wonder hypertension is called the “silent killer.”



What contributes to hypertension and HF?

Several factors contribute to hypertension and heart failure.

These include:

- A) Age
- B) Overweight or obesity, particularly morbid obesity
- C) Genetics and family history
- D) Race
- E) Physical inactivity
- F) Tobacco abuse
- G) Excess alcohol intake
- H) Excess dietary salt in susceptible individuals
- I) Stress

A. Age

As people age, their tissue becomes less elastic and stiffer. The stiffening affects the heart muscle and blood vessels resulting in higher pressures in the circulatory system. Overtime, weight gain, a poor diet and a sedentary lifestyle have a cumulative effect of damaging the heart and blood vessels.

B. Overweight or obesity

The American Heart Association describes obesity as a major risk factor for cardiovascular disease. What exactly is obesity?

Metropolitan Life's height/weight tables are often used to determine a recommended weight for an individual based on age and gender. Generally, those who are 20% over the recommended weight for their height are considered to be overweight — but not necessarily obese. Obesity refers to fatness rather than weight. Men who have greater than 25% of their body weight as fat and women who have

more than 35% are considered to be obese. Obesity and being overweight carry significant health risks, are directly related to cardiovascular risk factors, and may:

- raise triglycerides (the “bad” blood fat)
- lower HDL-cholesterol (the “good” cholesterol)
- raise LDL-cholesterol (the “bad” cholesterol)
- raise blood pressure
- increase the risk of developing diabetes, and
- increase the risk of metabolic syndrome and insulin resistance

Obesity may be related to both genetics (nature) and lifestyle (nurture). Generally speaking, obesity occurs

when the calories we consume exceed the calories we burn through activities of daily living and exercise. We store the excess calories as fat reserves, thus contributing to obesity and ultimately increasing the risk of cardiovascular disease. Obesity has increased in men and women in every decade over the past 50 years.

There is a misconception that Americans are overeating and eating too much fat. In fact, as a nation we are eating less fat, fewer calories, and still gaining weight — primarily due to the lower levels of physical activity in our youth and adult lives. A sedentary lifestyle could be the real culprit.

C. Genetics and family history

A **family history** of cardiovascular disease is a risk factor for men younger than 40 and women younger than 50. It could reflect genetics and/or an unhealthy family lifestyle. If most of your family members smoke, are sedentary, and have a poor diet — then these are harmful habits that increase the risk of heart disease in your family. However, unlike your genes, these behaviors can be changed.

On the other hand, if your family has a healthy lifestyle but there is still a high incidence of cardiovascular disease, then it is likely that genetics is playing a role. In either case, by practicing a healthy lifestyle, you can help reduce your risk rather than giving up and thinking you have no control over your destiny.

D. Race

Individuals with certain ethnic backgrounds are at a greater risk of developing heart failure due to the prevalence of high blood pressure. According to the American Heart Association, one risk factor that contributes to HF is high blood pressure. African Americans have a higher prevalence of high blood pressure than Caucasians, so they may be more susceptible to heart failure.

E. Physical inactivity

Lack of exercise is a major contributor to obesity, diabetes, and hypertension. Beginning an exercise program may help you feel better, have more energy, lose some weight, lower your cholesterol, lower your blood pressure, and improve your muscle tone. We will discuss exercise recommendations in the next section.

F. Tobacco abuse

What about smoking? Don't do it. Smoking is bad for the entire cardiovascular system because it:

- Introduces carbon monoxide into the body
- Directly harms the blood vessels
- Increases blood pressure and heart rate
- Increases the risk of a heart attack

Smoking has harmful effects, especially for anyone who has already had a heart attack or bypass surgery. More importantly, there is an increased risk of a second heart attack or need for stent placement or another bypass surgery if you continue to smoke after an initial cardiac incident.

Smoking is also a risk factor for **peripheral vascular disease** (blockages of the arteries to the brain, kidneys, and legs).

G. Excess alcohol intake

A common concern for individuals with heart failure is alcohol consumption — mainly because there seems to be conflicting evidence about the benefits versus the risks of drinking. Experts agree that excess alcohol consumption over time can lead to many harmful effects, including high blood pressure, cirrhosis of the liver, and damage to the heart. The issue is the balance between **moderate** and **excessive** alcohol consumption.

While evidence shows that there is a protective effect for **moderate** alcohol consumption, this benefit disappears with excessive intake. Men should consume no more than 2 drinks* daily, and women, because of their smaller body size, should not consume more than 1 drink* each day. The 7 to 14 allowable drinks in a week should not be consumed in a few days or during a weekend of binge drinking. Drinking alcohol for cardio-protection is not a good idea.

***A guide:** One drink is defined as 5 ounces of wine, 12 ounces of beer, or 1-1/2 ounces of 80-proof liquor.

People who should not drink alcohol include individuals with high levels of triglycerides in their blood (over 300 mg/dL), women who are pregnant, individuals who are under age, people with a genetic predisposition for alcoholism or who are recovering from alcoholism, and those taking certain medications. Because alcohol affects blood pressure, people who have high blood pressure should not have more than 1 drink per day. Also, a cardiologist may ask individuals who have been diagnosed with atrial fibrillation or cardiomyopathy not to consume any alcohol.

H. Excess dietary salt

Salt helps conserve water in your body. The American Heart Association Step 2 diet recommends that the average person consume no more than 2,400 mg of salt per day, especially those individuals who are salt sensitive. Excess dietary salt may contribute to both hypertension and to your body retaining too much water.

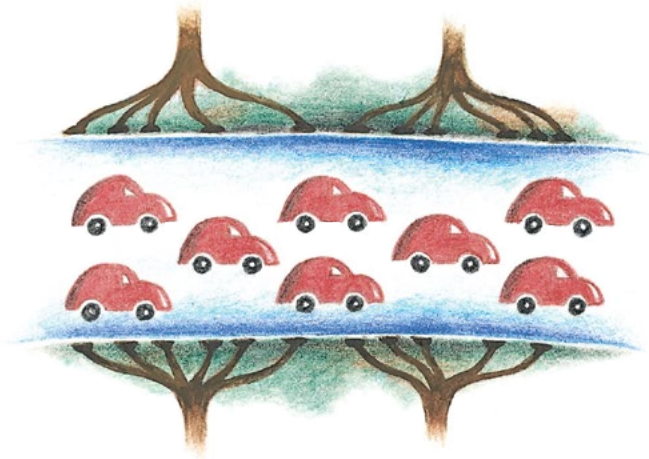
If you are retaining too much water, then you are increasing your blood volume (cars) without adding space. This increase will result in more pressure in the arteries.



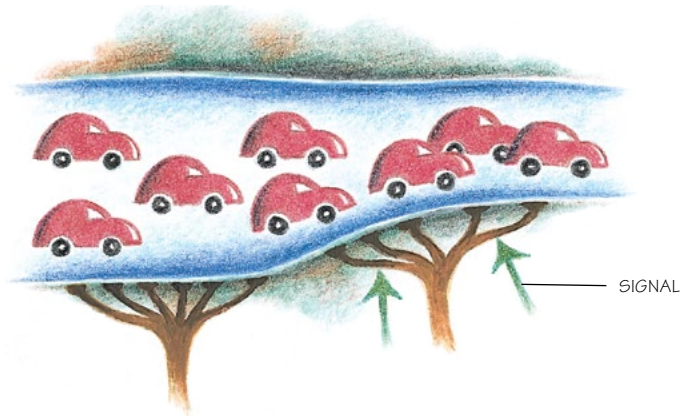
I. What about stress?

When you are under stress, your brain releases signals to the body through the nerves and hormones. These signals allow your body to respond to various situations. Whether chronic stress or reactions to stress raise blood pressure is hard to define and even harder to treat because stressors are usually related to the environment and lifestyle.

Arteries have nerves attached to them. The nerves can either cause the arteries to relax or can put more tension on the walls of the arteries. If you are under a lot of stress, the nerves send signals to tighten or narrow the arteries.



Narrowing the artery is like taking away a lane of traffic. The same number of cars (blood) need to move through a smaller space (artery). This increases the pressure inside the artery.

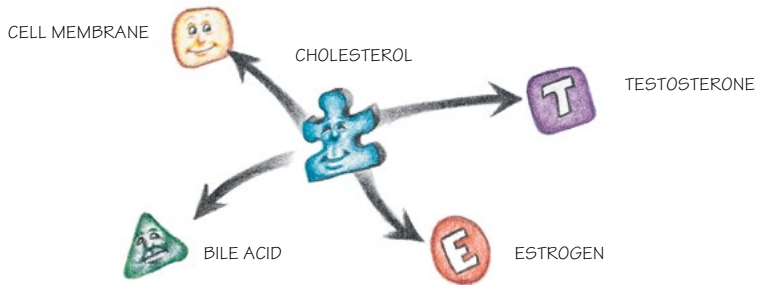


So,

something you can do to improve your blood pressure is reduce stress. You can accomplish this by praying, doing deep breathing exercises, or doing exercise such as going for a walk, riding a bike, or taking a swim.

2. High cholesterol and heart disease

Cholesterol is a waxlike substance that serves as a building block within the normal **cell membrane**. Cholesterol is also used to make **hormones**, especially **estrogen** and **testosterone**. It is also used to make **bile acids** that help break down fat in our intestines.



Why is elevated cholesterol so harmful?

Cholesterol is carried through the bloodstream on molecules called lipids. There are different types of lipids that your doctor may discuss with you. LDL-cholesterol is considered the “BAD” cholesterol and HDL-cholesterol is considered the “GOOD” cholesterol. Cholesterol is the building block of atherosclerotic plaques that can restrict blood flow to the heart.

How is high cholesterol treated?

The American Heart Association (AHA) and the American College of Cardiology (ACC) create the guidelines for managing blood cholesterol. High cholesterol has a long-term, cumulative effect of damaging a person's entire cardiovascular system. The guidelines stress the importance of lifestyle modifications such as:

(1) adhering to a heart-healthy diet, (2) exercising regularly based on your doctor's recommendations, and (3) avoiding tobacco products.

For individuals who cannot lower their cholesterol with diet and exercise alone, the AHA/ACC guidelines provide recommendations on when to start cholesterol-lowering medications. Your doctor may use a “risk calculator” or other screening tests to determine the best treatment option.

The first-line medication to lower cholesterol is a statin. Statins have the most scientific evidence supporting their role in reducing the risk of heart disease, heart attacks and strokes.

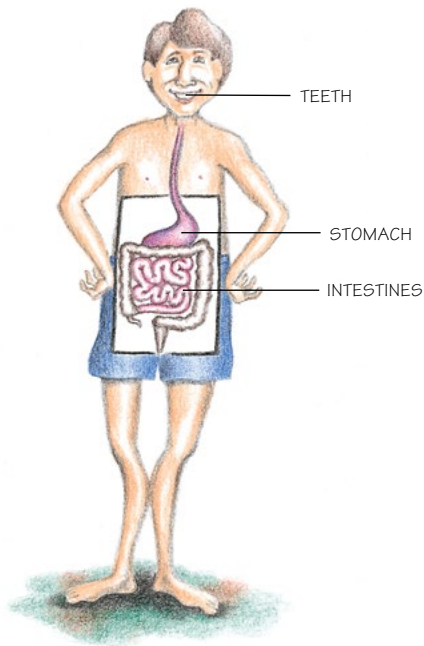
Two other medications your doctor may consider are ezetimibe and PCSK9 inhibitors. Ezetimibe may be

prescribed along with a statin for some individuals with high cholesterol. For a small portion of the population that does not respond well to statin therapy or cannot tolerate statins, a doctor may prescribe a PCSK9 inhibitor. PCSK9 medications are very effective but are also fairly expensive. Talk to your doctor about whether a statin (with or without ezetimibe) or PCSK9 inhibitor provides the most benefit based on your medical history and your health care coverage.

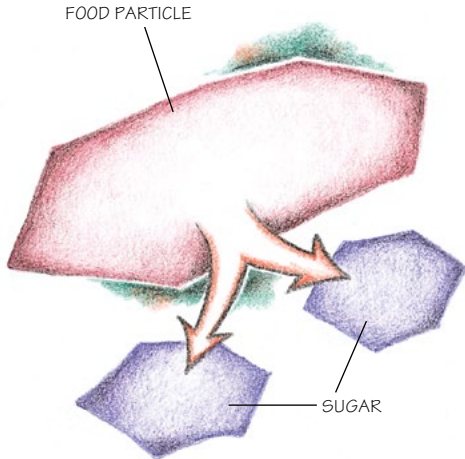
High triglycerides can contribute to cardiovascular disease, so your doctor may also prescribe a medication to help lower your triglycerides.

3. Diabetes

What exactly is diabetes? The working cells need sugar for energy. Sugar is absorbed through the digestive system after a meal or snack. **Insulin** is released by the **pancreas** to allow the body to use sugar as a source of nutrition and energy. That may be hard to visualize. This may help ...

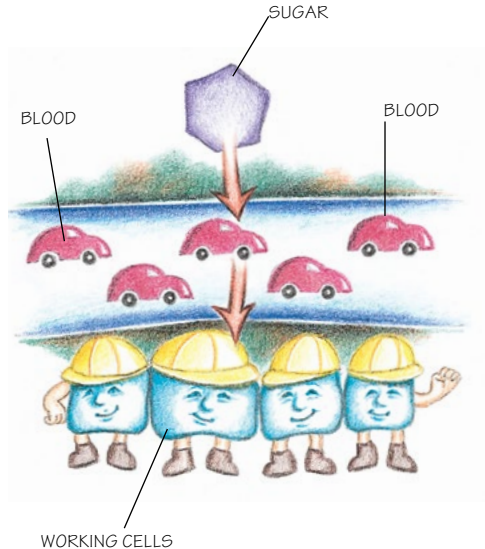


While you eat, the digestive system (teeth, stomach, and intestines) breaks your food down into smaller particles that are used by your body.



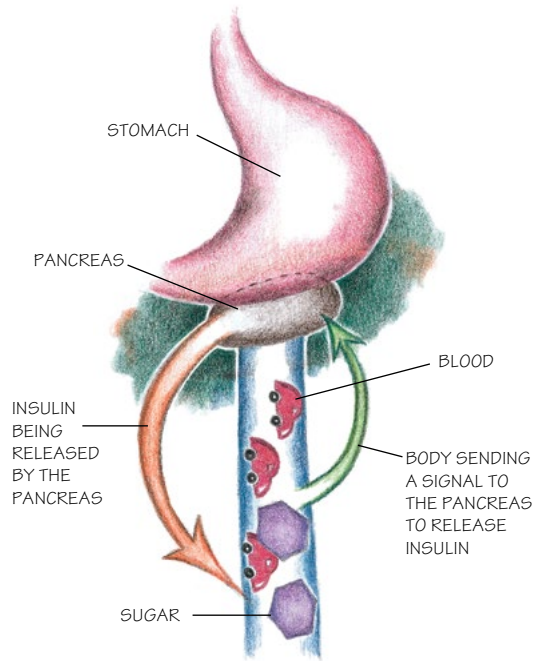
Some food is broken down into particles of **sugar**. Sometimes this sugar is referred to as **carbohydrates** or **glucose**.

Sugar moves from the digestive system to the blood and travels throughout the body to feed the working cells. The sugar is the energy packet the cells need to do work like running and breathing.

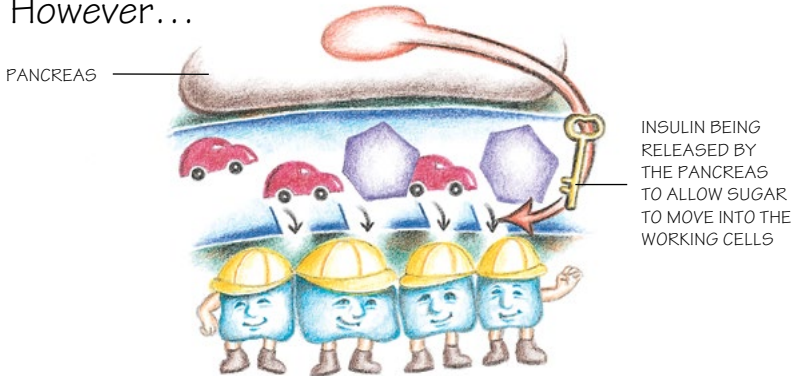


At the same time the sugar moves into the blood, the body sends a signal to the **pancreas** telling it to release **insulin** into the bloodstream.

Insulin is released from the “beta” cells of the pancreas.



Insulin acts like a **key** that unlocks the doors of the cells to let sugar move in. The working cells can then use the sugar for energy to do their jobs. This is how your body uses sugar. However...



...without the key (insulin), the sugar cannot get out of the bloodstream and into the working cells.

The sugar builds up in the blood, and the working cells get hungry. This is what happens in diabetes: the body cannot move sugar from the blood into the cells.

Diabetes is a major risk factor for cardiovascular disease. It is estimated that half of all type 2 diabetes patients have some form of coronary heart disease prior to being diagnosed with diabetes.

4. Diseases of heart valves

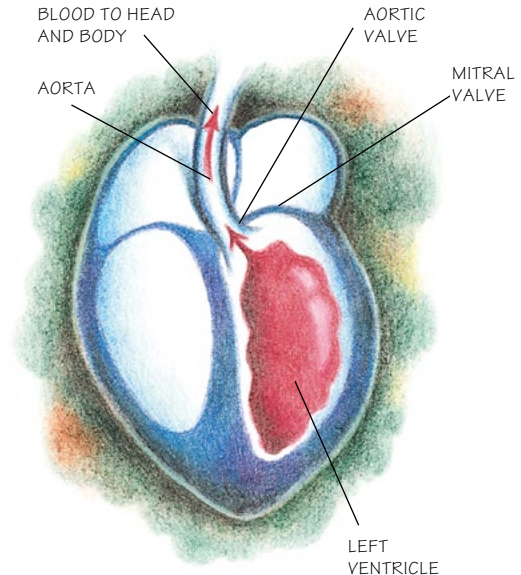
Heart valves work by opening and closing in a timed fashion so blood travels in 1 direction in the heart. When valves are diseased and do not function well, 1 of 2 processes can occur:

- 1) Regurgitation or “leaky valve” — blood flows backward instead of forward
- 2) Stenosis — valve does not open well, leading to obstruction of forward flow through the chambers of the heart

The 4 valves of the heart are:

- Aortic
- Mitral
- Pulmonic
- Tricuspid

The 2 left-sided valves (aortic, mitral) are the common targets of conditions that can lead to HF.



5. Heart rhythm abnormalities

Every heartbeat starts with an electrical impulse that travels through the heart in a regular pattern to coordinate contraction of the heart muscle. Irregularities in the pattern of beating (**arrhythmia**) or abnormal frequency of beating (**tachycardia** – too fast, **bradycardia** – too slow) can lead to the dysfunction of heart contraction and thus heart failure.

In rare instances, the irregular heartbeats can be life threatening. For example, you may notice your heart is beating faster than normal or “racing.” Be sure to contact your cardiologist to discuss any irregularities you notice with your heartbeat.

6. Infections

Infectious agents can attack different parts of the heart and lead to heart failure. These diseases include **myocarditis** (infection of the heart muscle), **endocarditis** (infection of the heart valves) and **pericarditis** (infection of the outer layer of the heart called the pericardium).

Viruses are the most common cause of myocarditis and pericarditis. Bacteria are the most common cause of endocarditis.

7. Toxins: chemotherapy and alcohol

Chemotherapy (Chemo). Chemotherapy can be extremely beneficial in the treatment of cancer. However, some classes of cancer treatment medications may damage your heart. If your oncologist recommends chemotherapy, ask your doctor to add a cardiologist to your treatment team.

Alcohol. As mentioned on pages 53-55, there are concerns about determining a prudent level of alcohol consumption. For certain individuals, regular or increased levels of alcohol consumption may contribute to heart conditions such as heart failure and an irregular heart rhythm. In particular, if you have been diagnosed with atrial fibrillation or cardiomyopathy, talk to your cardiologist about whether or not you should consume any alcohol.

Principles of Treatment

Principles of treatment

1. Lifestyle modifications
2. Medicines
3. Interventions and surgeries
4. Ablation, pacemakers and defibrillators
5. Assist/replacement therapies

1. Lifestyle modifications

Changes in your lifestyle can dramatically improve how you live with HF. These include:

1. Monitoring salt and fluid intake
2. Weighing yourself daily
3. Monitoring your blood pressure
4. Exercising

As noted earlier, the heart and kidneys have an important relationship when it comes to regulating the amount of fluid in our blood and our bodies. In HF, the kidneys hold onto too much sodium and fluid thereby contributing to congestion.

To help control the symptoms of congestion, it is important to:

- 1) Restrict sodium intake
- 2) Restrict fluid intake
- 3) Weigh yourself daily

Your doctor will help you with specific targets for each of these 3 items.

Blood pressure monitoring is very important in improving how you live with HF. Many of the medicines that control HF and heal the heart also affect blood pressure. Therefore, daily measurement can help your doctor optimize the use of these medicines.

Exercise is an important factor in maintaining or improving your health. Our discussion will be separated into 2 parts:

- Exercise for those who have HF and
- Exercise for those who do not have HF but who may be at risk of developing HF

For those who have HF

You should ask your doctor for an exercise prescription. Your doctor may enroll you in a cardiac rehab program or order an exercise stress test to help recommend the right exercise regimen for you.

If you have not exercised in a long time, start off very slowly. You may want to try walking or stationary cycling. A good way to begin is with intervals. What is interval training? Keep reading.

Always follow your doctor's advice regarding exercise.

How hard and how often should I exercise?

When you are just starting out, try to exercise very comfortably. Here are 4 quick tips.

- 1) Try to exercise so that you are breathing noticeably but are not out of breath. Remember this simple rule: you should be able to carry on a conversation while you are exercising.
- 2) Sweating is a good thing. This means that your body is working hard enough and receiving the necessary stimulus for the muscles and the heart.

- 3) If you are not fatigued and are completely recovered from exercising on the previous day, then you should exercise **daily**.
- 4) Give yourself a **warm-up** before exercise (several minutes of easy walking) and a **cooldown** at the end of exercise (again, several minutes of easy walking). Ask an exercise specialist for some recommendations for stretching after your workout, and discuss the intensity of the exercise with your doctor. **If you feel any chest discomfort, lightheadedness, or other concerning symptom, stop your exercise.**

What if I do not have HF?

Actually, a lot of the same principles apply.

- 1) Ask your doctor for an exercise prescription. If you have cardiovascular risk factors or you have been sedentary, you may need a stress test before starting your exercise program.
- 2) Begin with a simple interval training program. You may increase the time by 1 minute each week.

Sample interval training schedule

- Week 1** 1 minute walking or cycling/
1 minute rest for 5 to 10 intervals
- Week 2** 2 minutes walking or cycling/
1 minute rest for 5 to 10 intervals
- Week 3** 3 minutes walking or cycling/
1 minute rest for 5 to 10 intervals

A reasonable goal would be to gradually increase your exercise routine over 6 weeks until you are exercising 20 to 30 minutes comfortably each day.

Again, remember:

- 1) Be sure to give yourself at least 5 minutes of easy warm-up and cooldown. You may also want to add some light stretching exercises.
- 2) Stop exercising and consult your doctor immediately if you feel chest discomfort or other concerning symptoms with exercise.

2. Medications

Let's review some commonly prescribed classifications of medications used with heart failure. Whether these medications are used depends on the type of HF:

- 1) HF with preserved ejection fraction (HFpEF)
- 2) HF with reduced ejection fraction (HFrEF)

Diuretics

Blood is 92% water. If the kidneys cannot properly remove excess water, blood volume will increase. This results in fluid retention (**edema**) and shortness of breath. Diuretics target the kidneys. They help to eliminate excess water and decrease overall blood volume.

ACE inhibitors and ARBs

ACE (**angiotensin converting enzyme**) inhibitors and **ARBs** (**angiotensin receptor blocker**) block the toxic effect of a hormone called **angiotensin II** that is elevated in patients with heart failure. These drugs vary with respect to their peak effective daily dose and the required frequency of administration.

Angiotensin receptor-neprilysin inhibitor (ARNI)

This combination of 2 medicines is prescribed for patients with HFrEF. It is very effective in reducing stress on the heart and preventing congestion.

Beta blockers

When the heart fails, the body increases levels of **adrenaline** in the blood in an attempt to stimulate the heart muscle to work harder. Over time, adrenaline fatigues the heart and has a negative effect. Beta blockers can “block” the effect of adrenaline on the heart muscle and may prevent heart muscle deterioration. Beta-blocker therapy should be started at low doses and must be carefully monitored by your doctor.

Beta blockers are prescribed for people with HFrEF.

Digoxin

When the heart beats, it contracts forcefully to pump out the blood. If the heart has been damaged, the force of the contraction may have been reduced. Digoxin increases the force with which the left ventricle contracts. Because digoxin can also slow the heart rate, it is prescribed for patients that have atrial fibrillation.

Cholesterol-lowering and antiplatelet therapy

If heart failure is due to a heart attack and coronary artery disease, medications typically prescribed to treat coronary artery disease (cholesterol-lowering medicines and aspirin) may reduce the likelihood of repeat cardiac events (ischemia and heart attack).

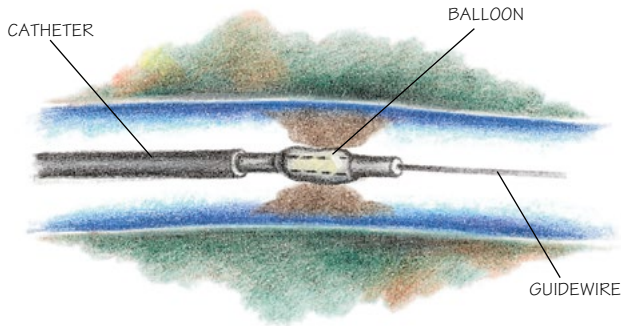
Interventions and surgeries

Many procedures can help the heart heal and function better. Typically these target 1 of 3 aspects of the heart:

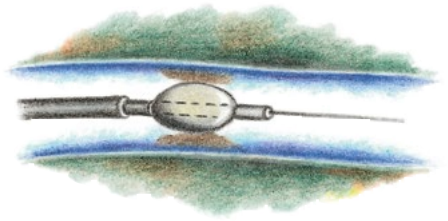
- 1) Arteries
- 2) Valves
- 3) Electrical system

Angioplasty and stent

Coronary angioplasty and stent placement is currently the preferred treatment for a heart attack. Angioplasty is a procedure by which the cardiologist inserts a balloon catheter over a thin wire across a blockage of a coronary artery.



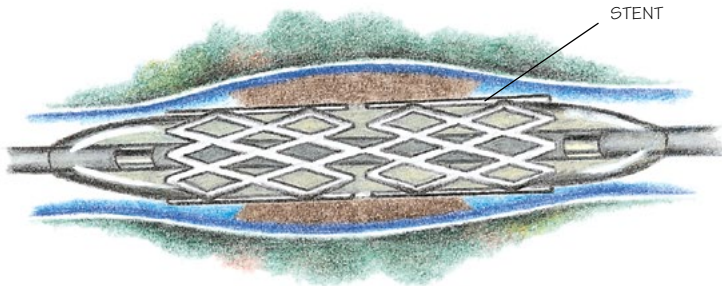
The balloon is inflated to compress the plaque. This is repeated as necessary to restore blood flow.



Inflating the balloon catheter compresses and disrupts the plaque, allowing blood to flow to the starved heart muscle.

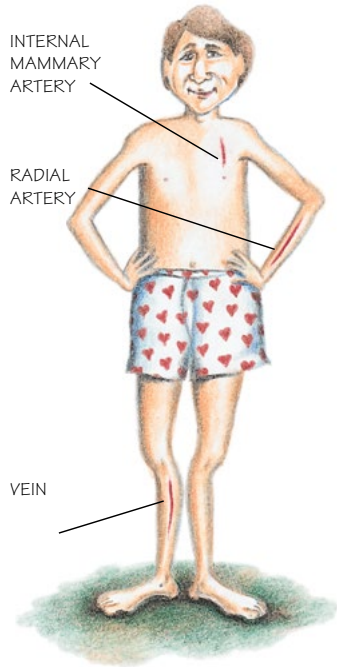
Stents

The cardiologist may decide to insert a **stent** inside the coronary artery. Usually made of stainless steel or other metal alloys, the stent functions as a scaffold to hold open the inside of the coronary artery.

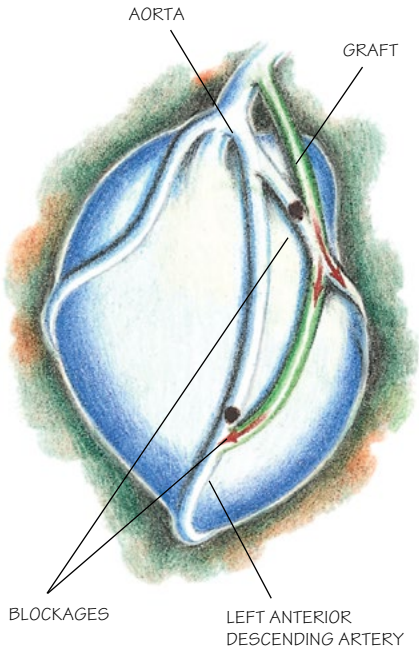


Bypass surgery

Bypass surgery is a cardiovascular procedure designed to correct blood flow to the heart that angioplasty cannot correct. The cardiovascular surgeon uses a piece of artery and/or vein to reroute blood around the blockage. Patients with HF may benefit from bypass surgery if reversible ischemia is the cause of heart muscle dysfunction.

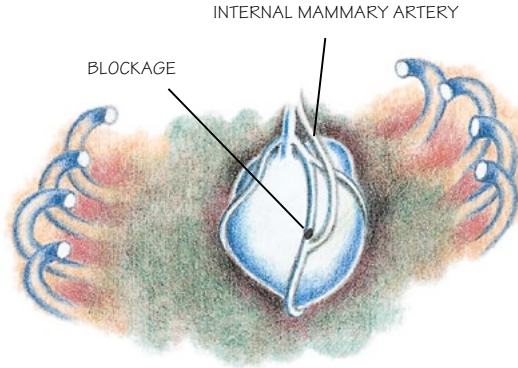


The surgeon may use a vein from the leg, and/or the internal mammary artery found in the chest, and/or the radial artery of the forearm.



The vein is attached to the aorta. The supply of blood is then rerouted around the blockage. One piece of vein may be used for multiple bypasses. The number of blockages where blood has been rerouted — not the number of veins used — determines the number of bypasses.

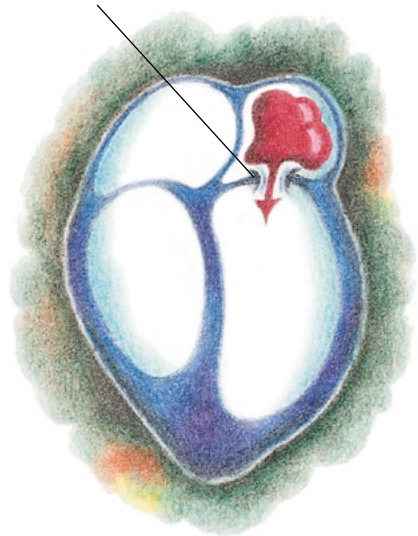
If the internal mammary artery is used, the artery originates from a branch off the aorta and is re-attached to the coronary artery downstream from the blockage.



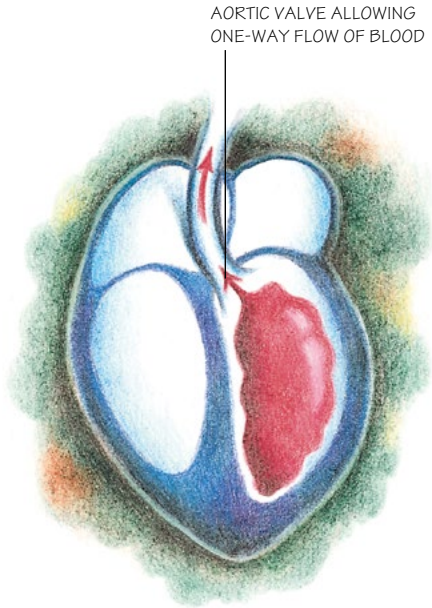
Valve dysfunction

The 4 valves inside the heart are one-way valves. For instance, the mitral valve allows blood to flow from the left atrium into the left ventricle.

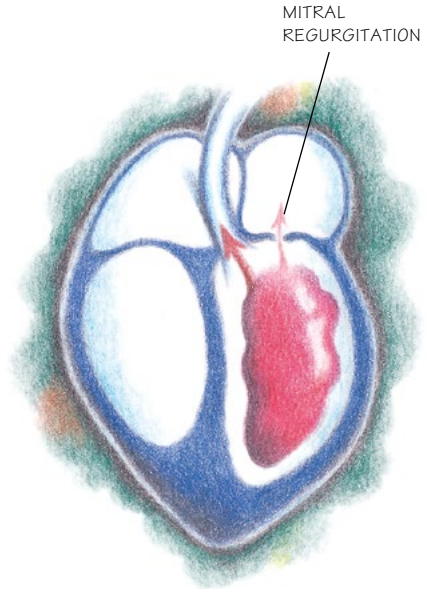
MITRAL VALVE ALLOWING
ONE-WAY FLOW OF BLOOD



When the left ventricle contracts, the mitral valve closes and the blood travels through the aortic valve out to the body.



If either valve loses some of its integrity or ability to close properly, then the blood may flow backward instead of forward. This leakage of the valve is called **regurgitation**.



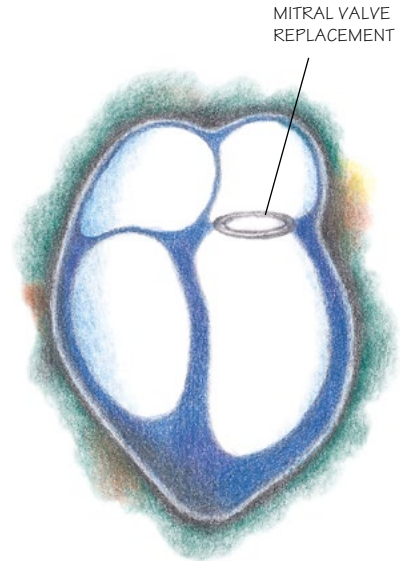
If significant stenosis or regurgitation occurs over a prolonged period of time, the heart works harder and harder to pump blood forward to the body and, with time, muscle damage and heart failure occur.

There are 2 options to treat valve regurgitation or valve stenosis:

- 1) Surgery
- 2) Transcatheter technologies

Surgical options to repair valves

A cardiac surgeon may repair either valve or, in certain instances, cut out the old valve and replace it with a new one. Repairing or replacing the valve can help restore normal (one-way) valve function.



4. Ablation, pacemakers and defibrillators

Treatments for these problems are divided into 3 categories:

- 1) Ablation procedures
- 2) Pacemakers
- 3) Defibrillators

Electrical abnormalities (arrhythmias) are common in patients with HF. Arrhythmias are abnormal heart rhythms that disrupt the heart rate and timing of contractions. This can lead to HF.

Arrhythmias can originate from the top (atrial) or bottom (ventricular) chambers of the heart.

Atrial fibrillation is a common arrhythmia in patients with HF.

Ventricular fibrillation and tachycardia is a life-threatening arrhythmia in patients with HF.

Ablation procedures

In an ablation, the cardiologist places a catheter into the chamber of the heart where the arrhythmia starts. The area is then treated with either radiofrequency to “burn” or with cryoablation to “freeze” the tissue so that the arrhythmia will not come back.

Pacemakers

Sometimes in patients with cardiomyopathy (weakened heart muscle), electricity is conducted abnormally through the heart leading to abnormal timing of contraction. In other words, the pumping motion is “out of sync.”

A biventricular pacemaker can be implanted to treat this timing abnormality. This device can improve the ejection fraction of the left ventricle and help prevent episodes of HF.

Defibrillators

When patients have cardiomyopathy, and specifically when the EF of the left ventricle is less than 35%, they are at risk of ventricular arrhythmias. These can be life threatening.

The best way to treat arrhythmias immediately is to implant a special device called an automatic internal cardiac defibrillator (AICD). In most instances the AICD can create a small electrical shock that will restore the normal rhythm of the heart.

Assist/replacement therapies

What happens if the left ventricle has been severely damaged by a heart attack, heart valve dysfunction or infection? Is there anything else that can be done?

There are 2 types of surgeries that can be done in patients who continue to struggle with symptoms of HF, often after undergoing many procedures and being on medication for years. These are:

- 1) Left ventricular assist devices (LVADs)
- 2) Heart transplant

Left ventricular assist devices (LVAD)

LVADs are mechanical pumps that assist with or take over the pumping responsibilities of the left ventricle.

These pumps are surgically implanted. They can prolong the lives of patients who have advanced heart failure and help them live very active lives.

The number of LVADs implanted in the United States exceeds the number of heart transplants. Progress in the technology is rapidly improving with smaller devices.

Heart transplant

Heart transplant is a surgery in which the sick heart is replaced by a donor heart. The transplant patient takes multiple medications to suppress his or her immune system so that the donor heart is not rejected by the body. Many critical issues determine who is a candidate for a transplant. If people are not candidates for heart transplants or they cannot wait long enough for a suitable organ to be available, often LVADs are implanted to save their lives.

And now for a little
heart to heart...

There are any number of reasons why someone may develop heart failure. They range from a heart attack to contracting an infection of the heart muscle to high blood pressure.

The point is this. If you have had a cardiac event, or if you think you may be at risk for cardiovascular disease, **now** is the time to take command of your life. We cannot control the past, but we can control what we do today and beyond.

See your doctor and have a complete physical exam. (The next section of this book contains questions you may want to ask your doctor.)

If necessary, sit down with a dietitian and review your current eating patterns. Then, if your doctor agrees, get moving. Start a simple exercise program — mainly walking. There are no guarantees that you will reduce your risk of having a cardiac event, but at least you will be taking an aggressive approach to improving your health.

Afterword

Your doctor will manage your care very closely.

Generally, the cardiologist may recommend that you:

- quit smoking
- lower your blood pressure to 120/80 mm Hg or lower
- discuss a cholesterol treatment plan with your doctor
- talk to your doctor about all your medications. Be sure to take your medications as directed
- keep strict control of diabetes and lower your A1C below 7%
- follow a heart-healthy diet and begin a basic exercise program, mainly walking

Your doctor will prescribe medications designed to improve your overall health. Be sure to follow these medication guidelines:

- Refill your prescriptions unless otherwise instructed by your doctor or physician's assistant.
- Take the medication as instructed.
- Take the medication at the prescribed time of day.
- Try not to miss taking the medication. Similarly, don't take extra doses.

Contact your doctor before discontinuing any medication.

Additional questions for your doctor:

- *What are my medications? What is each one for?*
- *What time of day should I take each one?*
- *Do I have any exercise limitations? What are they?*
- *Should I have a treadmill test before I start to exercise?
What is my target heart rate?*
- *Are there any concerns that I should be aware of before having/resuming sexual activity?*
- *Based on my weight, blood pressure, and blood cholesterol level, should I talk to someone about changing my diet?*

The Christ Hospital hopes that you have found the information in this book to be helpful. For additional information about services offered within The Christ Hospital Cardiovascular Team, please click on The Christ Hospital logo below:



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