

Coronary Artery Disease Consult



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Of Interest

Believe it or not, coronary artery disease can begin in childhood. To reduce the likelihood of this, the American Heart Association recommends that children 2 years of age and older eat at least five servings of fruits and vegetables daily. Children should also be offered a wide variety of other foods low in saturated fat and cholesterol. In addition, children should be physically active for at least an hour a day.

In This Booklet You Will Learn

- What coronary artery disease (CAD) is and how it can affect the body.
- Risk factors for CAD, and which ones you can control.
- Diagnosis and treatment.
- How to reduce your risks.
- How to live well with coronary artery disease.

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

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What Is Coronary Artery Disease?

Coronary artery disease (CAD) is a narrowing of the arteries that provide blood to the heart muscle. This narrowing is caused by a buildup of a fatty material called plaque (PLACK). The buildup itself is called atherosclerosis (ath-er-oe-skler-OE-sis). Many people refer to this as “hardening of the arteries.” Coronary artery disease can lead to heart attack and other serious consequences to your health.

Heart Attack Symptoms by Gender

When most people think of having a heart attack, the classic symptoms that come to mind are those that typically affect men. It is not well known that women often experience different symptoms. For example, nearly half of women do not experience chest pain during a heart attack. Symptoms that women commonly experience may be mistaken for conditions other than heart attack, such as indigestion. It is important to know the symptoms for both men and women.

Men

- Pain or discomfort in the center of the chest
- Pain or discomfort that spreads to the upper body, especially the shoulders or arms and neck
- Sweating
- Dizziness

Women

- Pain or discomfort in the center of the chest (not as frequently as in men)
- Shortness of breath
- Weakness, fatigue
- Nausea and/or vomiting
- Back or jaw pain



Healthy Blood Flow

A healthy artery has flexible walls and a smooth inner lining. Blood flows freely through the vessel, carrying oxygen to all parts of the body. When you are active, the body's demand for oxygen-rich blood increases. A healthy artery can easily handle the extra volume.

Right coronary artery

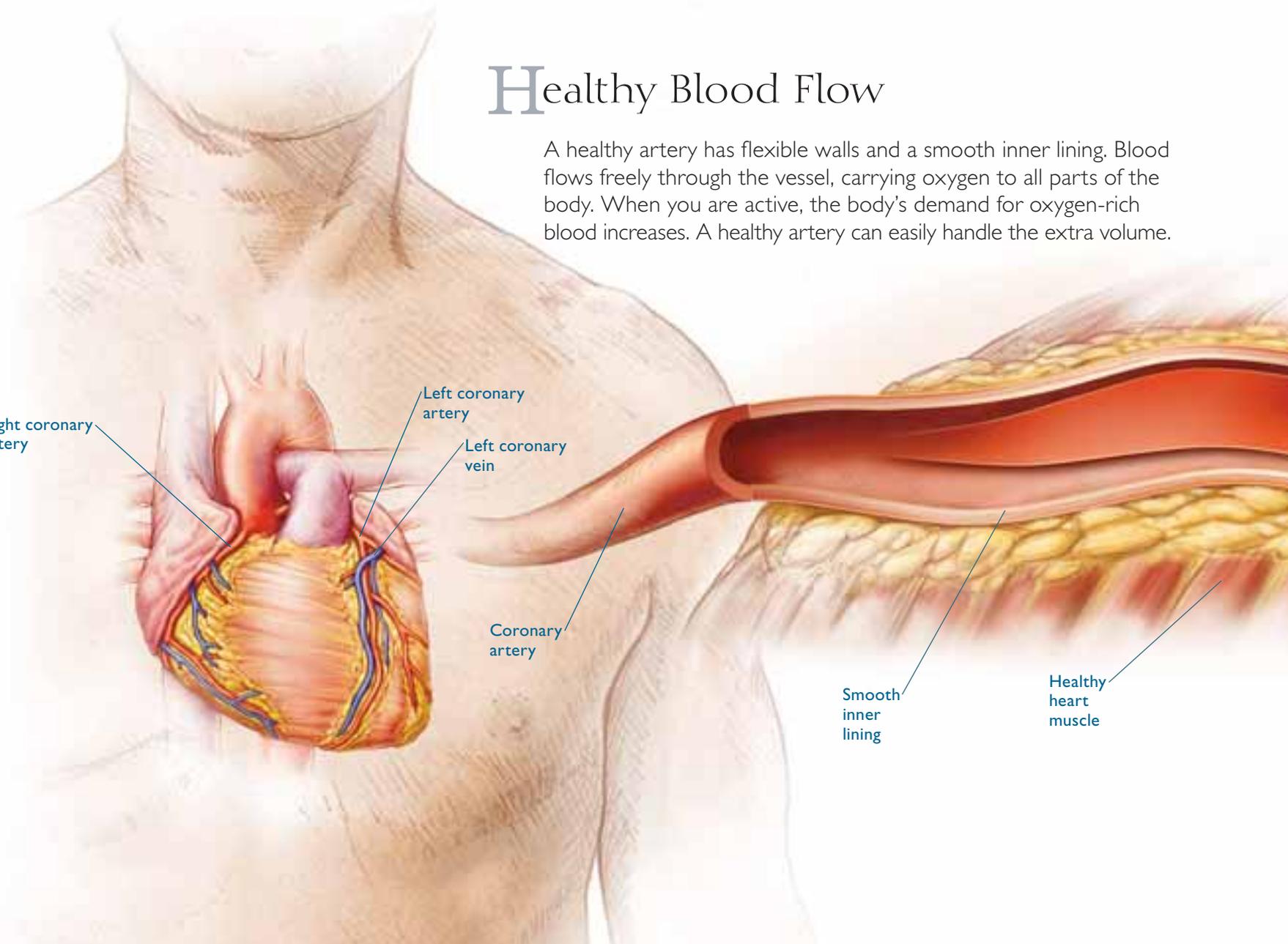
Left coronary artery

Left coronary vein

Coronary artery

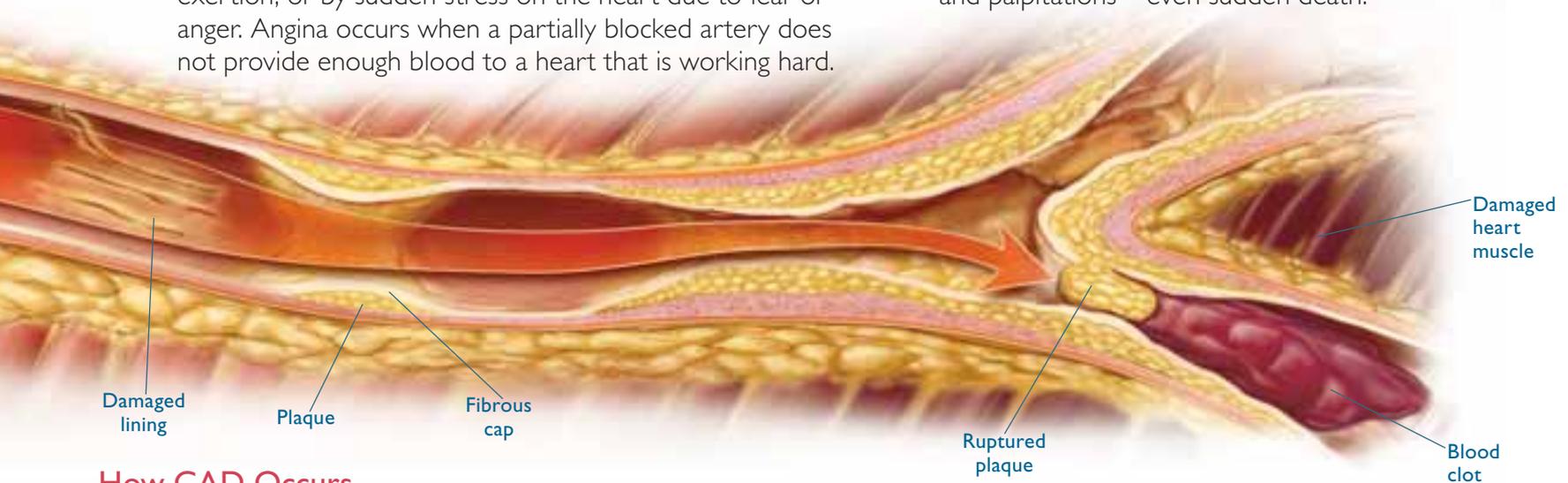
Smooth inner lining

Healthy heart muscle



Problems Caused by CAD

- **Heart attack.** Also called myocardial infarction, heart attack occurs when a coronary artery is totally blocked and a portion of the heart muscle is without oxygen for a prolonged period (ischemia). When this happens, the affected heart muscles dies.
- **Angina.** Most often experienced as chest pain caused by exertion, or by sudden stress on the heart due to fear or anger. Angina occurs when a partially blocked artery does not provide enough blood to a heart that is working hard.
- **Heart failure.** This occurs when the heart can't pump enough oxygen-rich blood from the lungs to the rest of the body. As a result, fluid can back up in the lungs, making it difficult to breathe.
- **Heart rhythm problems.** Abnormal heartbeat patterns, known as arrhythmias (a-RITH-me-ahs), can cause fainting and palpitations—even sudden death.



How CAD Occurs

1. The lining of the artery can be damaged by many factors, including smoking, diabetes, high blood pressure, and too much “bad” cholesterol. Changes in the artery wall cause inflammation. White blood cells and other substances rush to the scene.
2. The white blood cells form larger, cholesterol-rich “foam cells.” A cap of fibers forms over the pool of cholesterol-filled cells, and the artery wall underneath begins to thicken and stiffen, increasing the blockage of the artery.
3. Large plaques can hamper or block blood flow, but sometimes smaller plaques are a greater danger. That’s because smaller plaques have not developed a thick cap of fibers, and can more easily break open (rupture).
4. When a plaque ruptures, cholesterol spills into the inside of the artery, where blood is flowing. This causes a blood clot to form. If the clot grows large enough, blood flow through the artery stops, and the part of the heart supplied by that artery can die—a heart attack.

Risk Factors



Eventually, everyone is at risk of coronary artery disease due to the simple fact of aging. Certain risk factors, such as this, cannot be controlled. However, studies show that most people have at least one major risk factor that is within their control. Addressing the behaviors under your control may mean the difference between developing the disease or not.

Risk Factors You CAN'T Control:

- **Age.** Simply put, heart disease is more common in older people than in younger ones. More than 4 in 5 people who die from heart attacks are over age 65.
- **Gender.** Although heart disease is the leading killer of both men and women, men are more likely than women to develop coronary artery disease. Women, though, have poorer outcomes. They are more likely to die of a heart attack, and also more likely to die in the hospital after bypass surgery or an angioplasty procedure. Researchers are still trying to find the reasons for the differences.
- **Family history.** Coronary artery disease runs in families. Your risk of developing it is greater if you have a father or brother who was diagnosed before age 55, or if you have a mother or sister diagnosed before age 65. Scientists still have much to learn about the effect of genetics on this condition.
- **Ethnicity.** White people of European descent are less likely to develop coronary artery disease than are African Americans, Mexican Americans, American Indians, and native Hawaiians.

Risk Factors You CAN Control:

- **Tobacco use and exposure.** About 1 in 3 smoking deaths in the United States is from coronary artery disease. But quitting can greatly reduce your risk. Within a year of quitting, smokers cut their heart-disease risk in half. In 15 years, it is near that of a nonsmoker. Exposure to secondhand smoke (the smoke of others) also increases CAD risk.
- **Diabetes.** An adult diagnosed with type 2 diabetes has the same increased risk of heart attack as a person who already has had a heart attack. Researchers think that uncontrolled high blood sugar speeds the development of atherosclerosis. That's why it's so important to keep your blood sugar level under control.
- **Unhealthy cholesterol levels.** Our bodies need some cholesterol to work properly. But too much is not a good thing, particularly too much LDL cholesterol. Known as the “bad” cholesterol, excess LDL enters artery walls and starts the process of creating plaque, which blocks arteries. Exercise and a healthy diet help improve cholesterol levels. Medications also help to bring cholesterol within a healthy range.
- **High blood pressure.** The higher your blood pressure, the greater your chance of suffering a heart attack, heart failure, stroke, or kidney disease. The risk goes down as blood pressure goes down. Recent research suggests that the risk of coronary artery disease starts creeping up at a blood pressure of 115/75. Your ideal reading may vary from this, so talk with your doctor about setting a blood pressure goal that is in line with your health needs.





More Risk Factors You CAN Control:

- **Being overweight or obese.** By itself, excess weight is linked to an increased risk of heart disease. But for many people, excess weight also is linked with an increased risk of high blood pressure, diabetes, and a sedentary lifestyle. All of these factors further increase the risk of heart disease. So, if you are overweight or obese, losing some weight could greatly improve your health. In fact, losing just 10 percent of your weight can significantly lower your risk of developing all of these health conditions.

Body Mass Index

A reliable indicator of whether your weight is healthy is the Body Mass Index, or BMI. The BMI is a calculation based on height and weight, and it applies to both men and women. If your BMI is:

- 18.5 to 24.9, you are at a normal weight.
- 25 to 29.9, you are overweight.
- 30 or greater, you are obese.

- **Sedentary lifestyle.** If using the TV remote or the computer mouse is your idea of exercise, you have double the chance of developing coronary artery disease. Some people think that the only reason exercise is healthy is that it helps you avoid being overweight. This is wrong. Even if you aren't overweight, regular exercise greatly reduces your risk of heart disease and many other serious conditions.

A lack of exercise is as dangerous as smoking or high blood pressure. Getting off the couch can bring immediate rewards. In addition to lowering heart disease risk, moderate exercise for 30 minutes a day, most days of the week, will increase levels of “good” cholesterol (HDL), lower triglycerides, lower blood pressure, burn body fat, and lower blood sugar levels. You win all around.

- **Unhealthy diet.** In terms of heart disease risk, you are what you eat. A diet overloaded with fat, particularly saturated fat and trans fat, can tip the scales. Not only can it increase your chances of being overweight, it can also damage arteries and lead to full-blown coronary artery disease.
- **Stress, depression, and anger.** Psychological stress can raise blood pressure, reduce blood flow to the heart, decrease the heart's pumping ability, trigger abnormal pumping rhythms, and activate the blood's clotting system. Evidence also suggests that stress and constant anger may increase levels of triglycerides and “bad” cholesterol. Finally, for reasons doctors don't yet understand, depression makes people more vulnerable to heart disease.

Metabolic Syndrome

Each of the traits below is a risk factor for CAD. Together, these factors raise the risk even higher. Metabolic syndrome exists when three or more of the traits are present. If you have metabolic syndrome, your risk is especially high for heart disease, stroke, and diabetes.

- A large waist size (greater than 40 inches in men or 35 inches in women)
- HDL cholesterol that is less than 40mg/dL in men, and less than 50mg/dL in women
- Triglyceride level of 150 or higher
- Fasting blood glucose level of 110 or higher
- Blood pressure of 130/85 or higher

Your Diagnosis

Your doctor uses several techniques to diagnose heart disease. These include taking your medical history, performing a physical exam, and ordering diagnostic tests.

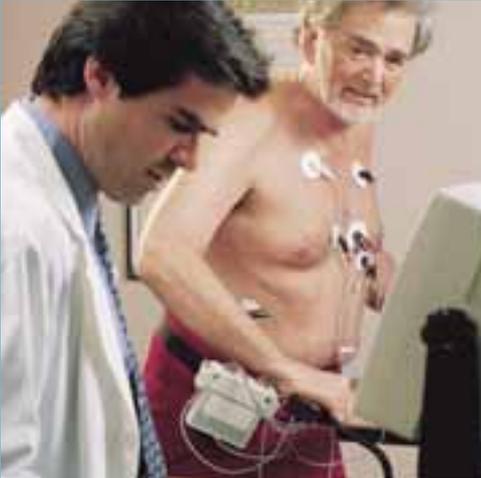
Your Medical History

Your doctor will ask about any symptoms you may be experiencing. If you have chest pain, your doctor will want to know when and where it occurs, and how long it lasts. This will help your doctor to determine whether the pain is related to heart disease (angina) or due to some other cause.

Your doctor also will record details of your medical background. Such things as smoking, diet, exercise, and family history of heart problems are important. Also mention any other medical problems you may have, such as high blood pressure, high cholesterol, or diabetes.

Physical Examination

Your doctor will measure your blood pressure, heart rate, and breathing rate. Using a stethoscope, your doctor will listen for heart murmurs and extra sounds that may indicate damage to the heart. He or she also may listen for signs that fluid is backing up into your lungs—a sign of heart failure. You might even be checked for other signs of fluid buildup. The veins in your neck and liver may be checked to see if they are swollen, and your legs and feet may be examined for puffiness.



Tests Your Doctor May Order

There are several tests your doctor may order to confirm a diagnosis of coronary artery disease and to find out its severity.

- **Routine laboratory tests.** Your doctor will probably order urinalysis and a blood chemistry test to check for diabetes or kidney disease. Both are more likely in people with atherosclerosis. The blood test also will indicate your cholesterol levels.
- **Electrocardiogram (EKG or ECG).** Commonly called an EKG, electrical sensors placed on the skin track the electrical activity of the heart. The test itself is painless, and takes only 1 to 2 minutes to perform. An EKG can spot permanent heart muscle damage, and sometimes can spot CAD that has not yet caused damage. It also can spot irregular heart rhythms if they occur during the EKG.
- **Exercise tolerance test.** This is also known as a stress test. During this test, which lasts about 10 to 15 minutes, an EKG and blood pressure readings are taken while you walk on a treadmill. If your condition allows it, the operator will increase the speed and incline of the treadmill until you feel short of breath, lightheaded, or otherwise uncomfortable. If you have had a heart attack or certain other problems, the doctor may stop the test after a predetermined period or when you reach a certain heart rate. If you are physically unable to take an exercise stress test, your doctor may give you medication that mimics physical exertion. This is called a pharmacologic stress test.
- **Holter monitor.** This test is essentially an EKG that lasts for 24 to 48 hours. Electrical sensors are attached to your body. Wires from the sensors run to a small box that fits in a jacket or purse, or can be carried over the shoulder with a strap. The box records your EKG wherever you are. You keep a written diary of your activities, including when you feel symptoms. This allows your doctor to see if your symptoms correspond to irregularities in your EKG that occurred at the same time.
- **Imaging tests.** Your doctor also may order one of the following tests to assess the extent of your coronary artery disease and the functioning of your heart.
 - Echocardiography forms pictures of your heart as it pumps.
 - Carotid artery ultrasound uses sound waves to look for atherosclerosis in the arteries leading to the brain.
 - Coronary arteriography (angiogram), with the help of dye injected through a catheter, provides x-rays showing the arteries of your heart.
 - Computed tomography (CT) angiography uses a CT scan to take pictures of the coronary arteries noninvasively, and is safer than coronary arteriography.
 - Electron beam CT does the same as coronary arteriography but may or may not use dye.
 - Magnetic resonance imaging (MRI) also takes pictures of the coronary arteries noninvasively. MRI does not have the radiation exposure of CT.

Your Treatment: Medications



Your healthcare provider is likely to discuss diet and exercise plans with you. Along with adopting these healthy living habits, you may need further treatment. If this is true, your doctor is likely to prescribe medications.

Blood Pressure Medications

These medications fall into five categories. Your doctor may prescribe one, or a combination, of these.

- **Diuretics.** Often called “water pills,” diuretics lower blood pressure by increasing urination, thereby lowering the amount of water in the body. They are very effective for most people, and doctors often prescribe them first.
- **ACE inhibitors.** Known formally as angiotensin-converting enzyme inhibitors, these drugs block production of a substance that constricts blood vessels. They also slow atherosclerosis and help treat people with heart failure. The drawback of ACE inhibitors is that they sometimes cause a persistent cough. Similar drugs, called angiotensin-receptor blockers, are less likely to cause cough, and may be prescribed instead.
- **Beta-blockers.** These medications limit the effect of stress-induced hormones. As a result, heart rate slows and the heart beats with less force, reducing the workload on the heart.
- **Calcium-channel blockers.** These dilate the coronary arteries, reducing blood pressure and the force of the heart’s contractions. They can be helpful for people who can’t tolerate other blood pressure medications.

Cholesterol Medications

- **Statins.** Considered one of the most important drug advances of the 20th century, these drugs greatly reduce blood levels of LDL (“bad”) cholesterol, and slightly raise blood levels of HDL (“good”) cholesterol. Statins also can stabilize plaque in artery walls, promote the growth of new blood vessels, and calm inflammation. Although statins do not work for everyone, they are the drug of choice in treating high cholesterol.
- **Fibric acid derivatives.** These drugs block the production and activity of proteins that carry cholesterol in the bloodstream.
- **Niacin.** This B vitamin, when taken in doses higher than the recommended daily allowance, acts as a drug. It interferes with the liver’s manufacture of LDL (“bad”) cholesterol. When taken along with a statin, niacin can lower LDL and triglycerides and raise HDL (“good”) cholesterol.

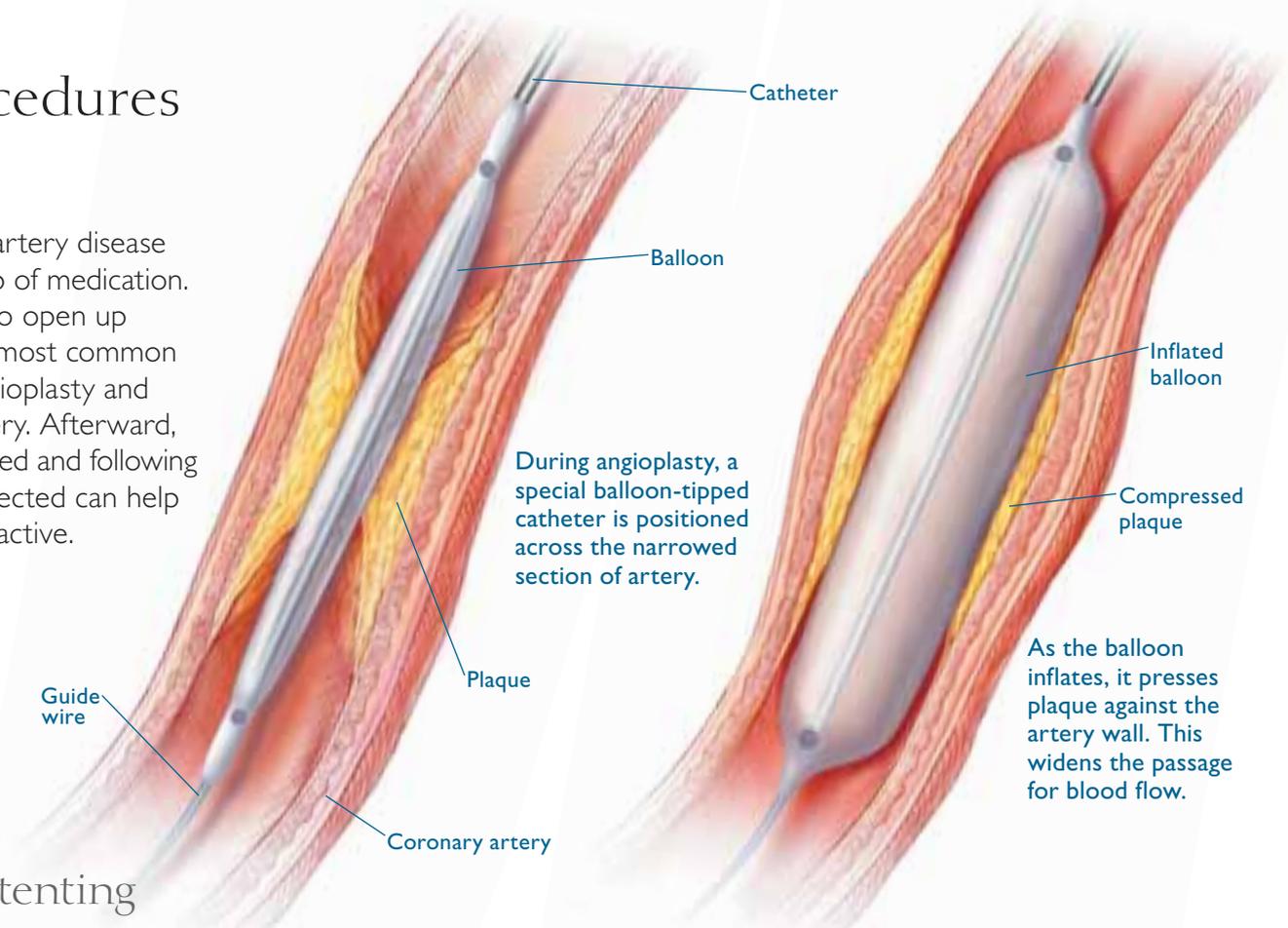
Other Medications

- **Aspirin.** An old standby, aspirin continues to surprise researchers with new uses. Recent studies have shown that taking an 81-milligram aspirin per day can help to prevent heart attack and stroke in men. For women, daily aspirin use does not seem to ward off heart attack, but it does reduce the risk of stroke.
- **Nitroglycerin.** Along with other nitrate drugs, nitroglycerin relaxes blood-vessel walls, lowering blood pressure and putting less strain on the heart. A certain form of nitroglycerin that is placed under the tongue can alleviate an attack of angina.



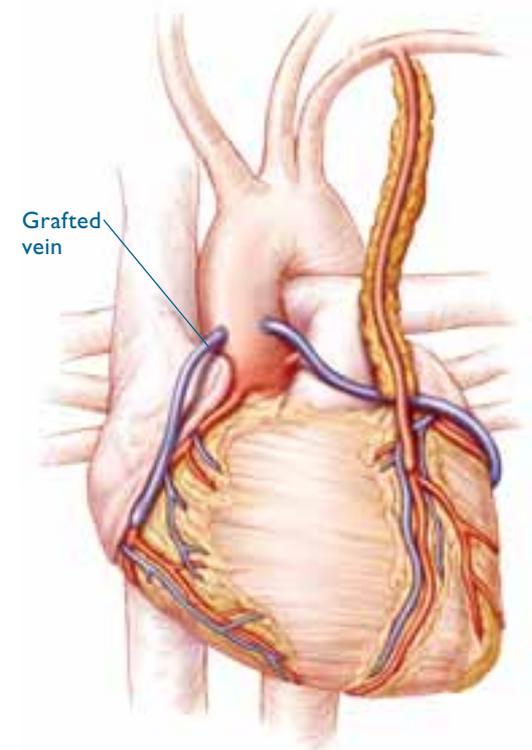
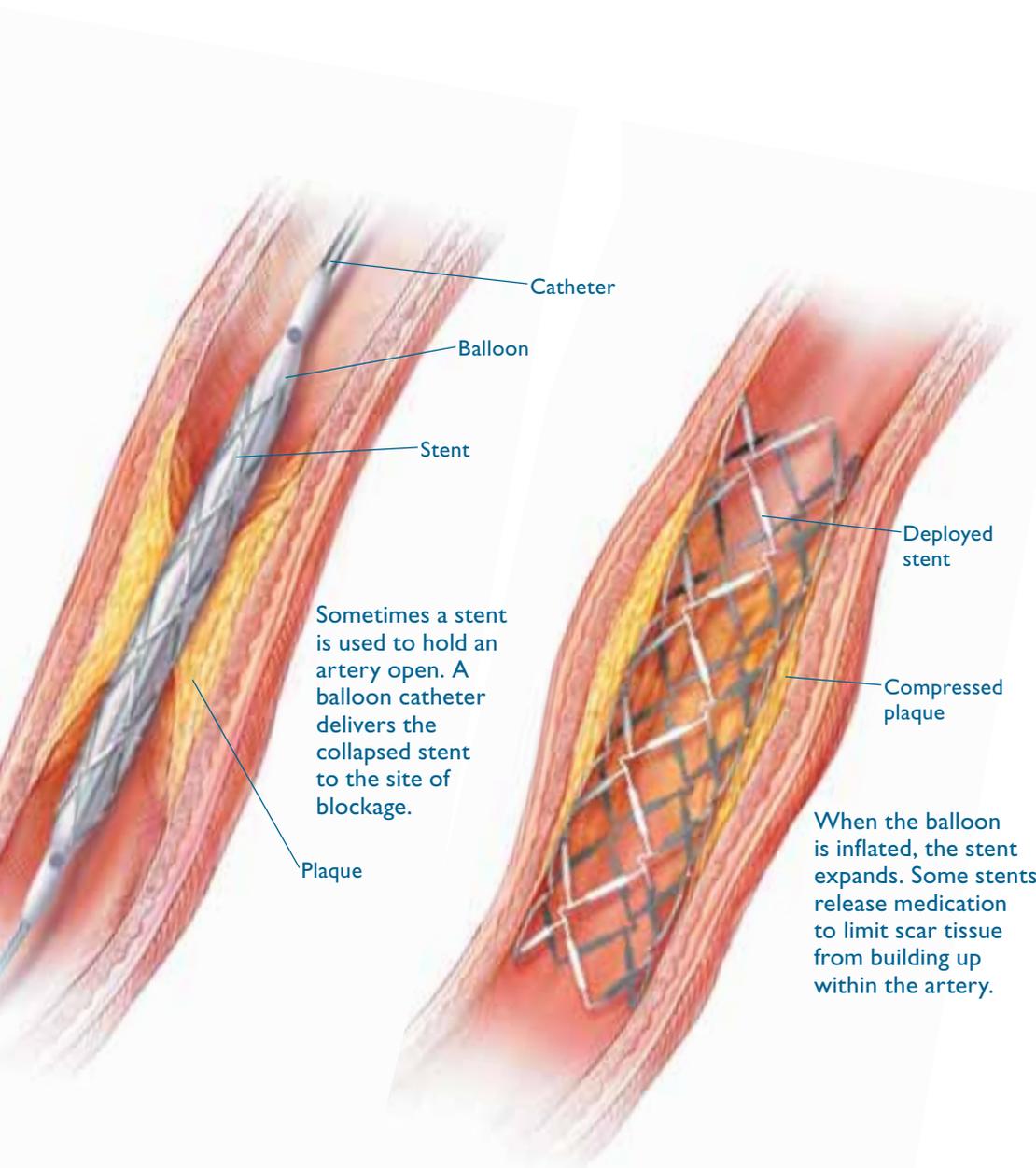
Treatment: Procedures and Surgery

Many people with coronary artery disease live normal lives with the help of medication. But some need procedures to open up narrowed arteries. The two most common procedures are coronary angioplasty and coronary artery bypass surgery. Afterward, taking medications as prescribed and following diet and exercise plans as directed can help you stay healthier and more active.



Angioplasty and Stenting

If coronary arteries are narrowed or blocked, angioplasty and stenting may be used to improve blood flow. Depending on the location and size of the blockage, one or both procedures may be done. First, a narrow tube (catheter) is inserted into an artery in your arm or leg. The tip of the catheter is gently guided through the artery, to the narrowed artery in your heart. At the tip of the catheter is a deflated balloon. Once at the blockage, the doctor inflates the balloon, which pushes the blockage against the artery wall and widens the passage where blood flows. Sometimes a stent (a tiny mesh tube) is mounted onto a balloon catheter. When inflated, the balloon both widens the blood flow passage and opens the stent. The stent remains in the artery after the catheter is removed.



Coronary Artery Bypass Surgery

If you have several blockages, or for some other reason angioplasty may not be appropriate for you, coronary artery bypass surgery might be recommended. In this procedure, a cardiac surgeon will take a blood vessel from elsewhere in your body and use it to “bypass” a coronary blockage. If you have more than one blockage, more than one bypass may be needed. This is a serious surgery, and you may need a few months to fully recover.

Reducing Your Risks



If you are diagnosed with coronary artery disease, it is vitally important that you live a heart-healthy lifestyle to lower your future risk of heart attack, stroke, and related serious illnesses.

This is true even if you have had angioplasty or surgery. Although these procedures can improve the obstruction from plaques you developed in the past, they don't prevent the development of new plaques or the rupturing of current ones. For that reason, it is vital to live a heart-healthy lifestyle that lowers your risk of coronary problems.

- **Stop smoking.** Today there are tools that double or triple your odds of kicking the habit. Research shows that nicotine replacement—by patch, gum, or other methods—combined with counseling or some other source of support can greatly increase your odds of success.
- **Get active.** Physical activity is one of the best ways to protect yourself against heart disease. How much is enough? The standard recommendation is 30 minutes of moderate activity at least five days of the week. If you need to lose weight, you generally should exercise 60 minutes every day. Moderate exercise includes:
 - Bike riding
 - Gardening
 - Golf (walking the course)
 - Housework
 - Mowing the lawn with a power mower
 - Raking leaves
 - Swimming at a slow pace
 - Walking at 3 to 4 miles per hour

- **Eat healthy foods.** You need to eat healthy in general, over the rest of your life. But this doesn't mean you must completely avoid certain foods. Yes, cake and ice cream every night are bad for you but are fine to have now and then. A heart-healthy diet includes:
 - Complex carbohydrates. These are found in whole-grain foods such as bread and pasta, as well as in fruits and vegetables. Limit simple carbohydrates, such as white bread.
 - Fruits and vegetables. Aim for at least five servings a day to protect against high blood pressure, heart disease, and stroke. Whole fruits (rather than juice) and those dark in color are particularly healthy.
 - Fiber. This indigestible carbohydrate has been shown to lower cholesterol and reduce the risk of heart disease and heart attack.
 - Protein. The body needs protein to build and repair muscles, skin, and cells. It is found mainly in red meat, fish, poultry, dairy products, nuts, and beans and other legumes. For better heart health, limit red meat and choose low-fat or fat-free dairy products.
 - Healthy fats. Monounsaturated and polyunsaturated fats (found in fish, nuts, and olive and peanut oils) help protect your heart. Omega-3 fat, found in fatty fish such as salmon and mackerel, is especially good for you. On the other hand, trans fats should be avoided. They can be found in stick margarine, fried foods, and commercial baked goods, snack foods, and puddings. Saturated fats, which come mostly from red meat, whole-fat dairy products, butter, and foods made with butter, should be limited.
- **Reduce stress.** Certain stress-reducing techniques may help to lower blood pressure. These include exercise, deep breathing and relaxation, counseling, and instruction on anger management.
- **Be skeptical about alternative therapies.** Few “natural remedies” have been shown to work in scientific studies. Before using any, talk with your doctor. People with heart disease may be especially at risk of interactions between their medications and alternative remedies.

What About Sex?



It's common for people with heart disease to have concerns about sex. Heart patients and their partners often wonder whether sexual intercourse is too strenuous. Although heart problems are more likely to occur in the first hour or two after intercourse, the risk is extremely low. And research has shown that regular exercise reduces the risk of heart attack during or after sex.

In men, the disease itself sometimes causes erectile dysfunction (impotence). Also, some heart medications cause sexual problems. Popular prescription medications, such as Viagra, Cialis, and Levitra, are often effective in dealing with erectile dysfunction. But such medications cause a dangerous drop in blood pressure if you use nitroglycerin or other nitrate medications that treat heart disease. If you take nitrates infrequently, you may be able to use medications to manage erectile dysfunction. Ask your doctor.

When considering the use of erectile-dysfunction drugs, the U.S. Food and Drug Administration also urges caution for people who:

- Have had a heart attack, stroke, or heart rhythm problem in the past 6 months.
- Have a history of heart failure or unstable angina.
- Have low blood pressure or uncontrolled high blood pressure.

If you experience angina during sex, tell your doctor. He or she may suggest taking a nitrate before sex. But if you do so, you cannot take erectile-dysfunction drugs.

Common Concerns

If you have one or more risk factors for coronary artery disease, see your doctor. If your risk is due to factors you can control, begin to make changes in your life, such as eating well and exercising regularly.

What You Can Do

To prevent coronary artery disease, or to manage it if I have it, I will:

- See my doctor.
- Eat a healthy diet.
- Lose weight, if I need to.
- Exercise regularly.

Further Reading

For additional information about coronary artery disease, visit our website:

www.health.harvard.edu

More information is available from:

▪ **American Heart Association**

www.americanheart.org

▪ **American Stroke Association**

www.strokeassociation.org

▪ **National Cholesterol Education Program**

www.nhlbi.nih.gov/chd



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