

written by
Harvard Medical School



Heart Disease

Angina and Heart Attacks



Patient Education Center

www.patientedu.org

During the next 30 seconds, somebody in America will have a heart attack. During the next minute, somebody will die from one. Some heart attacks come on without warning, but others follow years of pain and disability. Either way, heart disease is an American tragedy, particularly since prevention and treatment can be so helpful.

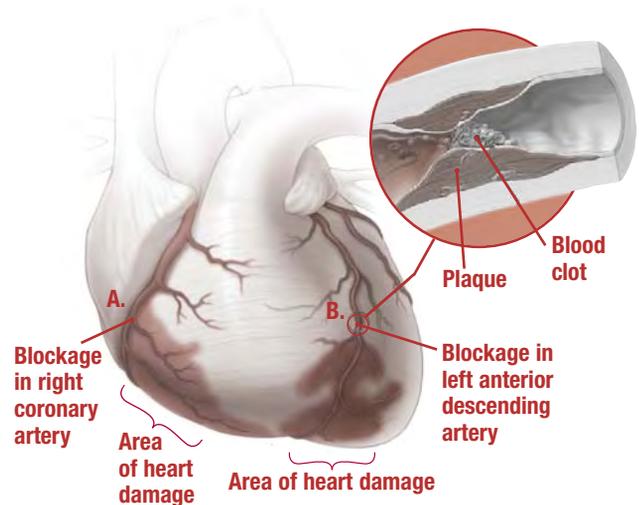
For more information about heart disease from Harvard Health Publications, go to www.patientedu.org.

Your Heart

Your heart is a remarkable muscle. Although it's no bigger than your clenched fist, it beats more than 100,000 times every day, pumping more than 2,000 gallons of blood through 60,000 miles of blood vessels. To match the heart's workload, your biceps would have to lift a 70-pound weight the distance of 1 foot every minute of your life.

To pump the blood that nourishes all parts of your body, your heart muscle needs its own supply of oxygen-rich blood. All that blood flows through two *coronary arteries* that branch out into a network of smaller arteries. But the largest coronary artery is only about 6 mm in diameter, no wider than a pencil eraser, so it's easy to see how blockages in these tiny arteries can cause big trouble.

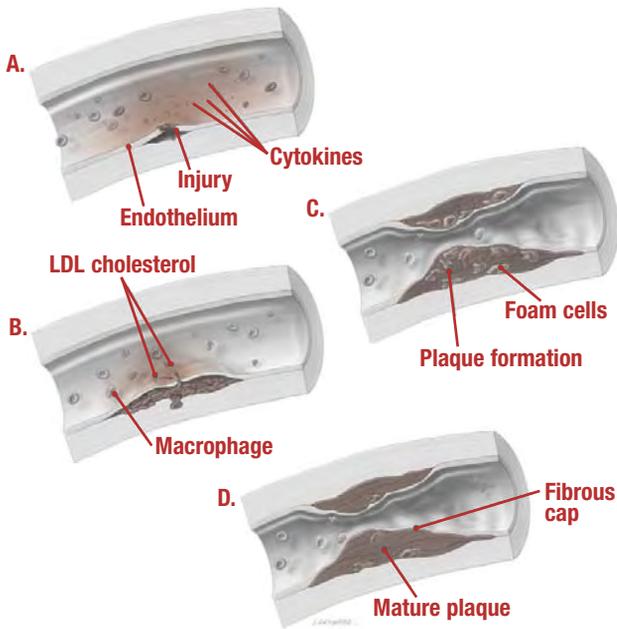
The blockages are called coronary artery disease (CAD); which causes *angina* or a *heart attack*.



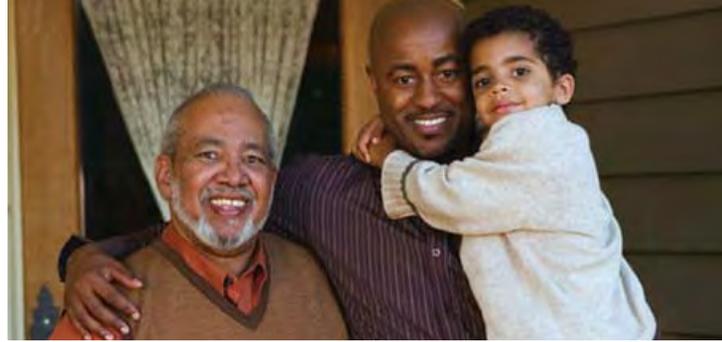
Blockages can occur in any of your coronary arteries. Two common sites are the right coronary artery (A) and the left anterior descending artery (B). When blockages occur in these locations, heart damage may result in the adjoining shaded areas.

Coronary Artery Disease

CAD is a serious form of *atherosclerosis* (“hardening of the arteries”). It develops when LDL (“bad”) cholesterol enters the artery wall. When cholesterol builds up, it causes fatty deposits called *plaques* (See below). If a plaque produces enough narrowing, your heart muscle can’t get the blood it needs; that’s what causes the chest pain of angina. It’s bad enough, but if a plaque ruptures, it triggers the formation of a blood clot on its surface. The clot closes off the artery, depriving the heart muscle of its blood supply. Muscle cells that depend on the blocked artery die, causing a heart attack.



(A) The walls of your arteries become injured by risk factors, and cytokines are released to help. This enables LDL cholesterol build up. **(B)** LDL cholesterol inside the injured artery wall causes inflammation. **(C)** Macrophages ingest the LDL cholesterol, becoming fat-laden foam cells and triggering additional inflammation. **(D)** A thin, fibrous cap forms over the fatty plaque, which can rupture, causing a clot and heart attack.



Who Gets CAD?

Affecting about 16 million Americans, CAD is the leading killer of men and women. But some people are more vulnerable than others; for example, men develop CAD about 10 years before women.

Some risk factors are unavoidable and cannot be modified. However, most people at risk of CAD have at least one major risk factor that can be modified (Table 1).

Table 1: Major Risk Factors

Factors That Cannot Be Modified

- Male Gender
- Family History
- Advancing Age

Factors That Can Be Modified

- | | |
|--|--|
| <ul style="list-style-type: none"> • Abnormal Cholesterol <ul style="list-style-type: none"> - High LDL (“bad”) Cholesterol - Low HDL (“good”) Cholesterol | <ul style="list-style-type: none"> • Diabetes |
| <ul style="list-style-type: none"> • High Blood Pressure | <ul style="list-style-type: none"> • Obesity |
| <ul style="list-style-type: none"> • Lack of Exercise | <ul style="list-style-type: none"> • Smoking • Psychological Factors <ul style="list-style-type: none"> - Stress and Anger - Depression and Isolation |

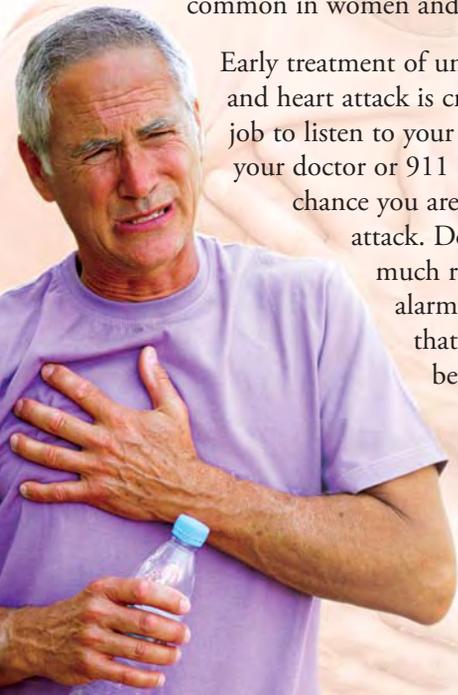
Symptoms

Chest pain is the most common symptom of CAD. It is often described as a strong squeezing pressure deep in the center of the chest or off to the left side. The pain can radiate to the neck and jaw or shoulders and arms, particularly on the left. Sweating, nausea, dizziness, lightheadedness, an erratic pulse, or shortness of breath may also occur in various combinations.

When the pain of CAD comes on after a predictable stress (such as exercise, strong emotion, or exposure to cold) and is relieved by rest or nitroglycerin (See page 10), it is called *stable angina*. If the pain starts without obvious cause or if it persists or recurs, it may represent *unstable angina* or a heart attack, which are medical emergencies.

CAD can be tricky to diagnose. Many other conditions can cause similar symptoms. On the other hand, some patients have unusual complaints or none at all. Silent CAD is most common in women and in diabetics.

Early treatment of unstable angina and heart attack is crucial. It's your job to listen to your body and call your doctor or 911 if there is any chance you are having a heart attack. Doctors would much rather see a false alarm than a tragedy that could have been prevented.



Diagnosis

Your doctor will ask if you've had symptoms of heart disease and if CAD runs in your family. Next, your doctor will check your blood pressure and examine your heart and circulation. You'll also be tested for cardiac risk factors (See page 5).

If your doctor suspects CAD, you'll need additional tests. Here are some of the most important ones:

- **Electrocardiogram (EKG).**

An EKG records the electrical activity of your heart and is most useful when obtained during episodes of pain. Many patients with CAD have normal EKGs, but others show scars from previous heart attacks.



- **Echocardiography (cardiac echo).** Doctors use cardiac echoes to measure the heart's size and pumping capacity and to evaluate the heart valves. Sound waves are beamed at your heart, and the impulses that are reflected back are displayed on a video screen and analyzed by computer.

Treatment: Lifestyle

Every patient with CAD needs to follow a heart-healthy lifestyle. And the same good habits can prevent heart disease from getting started in the first place. Some healthful tips include:

- **Stress tests.** Your doctors will put your heart to work by having you walk on a treadmill or by giving you medication. They monitor your blood pressure, heart rhythm, and EKG or echo to see if you have blockages. In some cases, you'll be given a radioactive chemical to produce nuclear images of your heart before, during, and after the stress.
- **Computed tomography (CT scanning).** This is performed in one of two ways. One type measures the calcium in plaques; another produces pictures of the coronary arteries.
- **Coronary angiography.** Cardiologists thread a tiny plastic catheter (tube) into the coronary arteries, and then inject a dye so x-rays can show blockages.

- **Blood enzymes.** During a heart attack, some heart cells die, leaking contents into the blood. Doctors measure blood *troponin* and *creatine phosphokinase* levels to learn if a heart attack has occurred.

- **Avoid tobacco.** Quit smoking and stay away from secondhand smoke.
- **Eat right.** Reduce your consumption of saturated fat and cholesterol by limiting red meat, whole dairy products, and eggs. Avoid trans fats in stick margarine, fried foods, and many snack and “junk” foods. Favor olive and canola oils. Eat plenty of fish. Load up on whole grain products instead of refined grains and simple sugars. Eat lots of fruits and vegetables. Cut down on sodium (salt). If you enjoy alcohol and can drink responsibly, limit yourself to one or two drinks a day.
- **Stay active.** People with CAD need medical supervision, but most can—and should—spend 30 minutes a day walking, biking, or doing other forms of moderate exercise.
- **Control your weight.** If you need to lose weight, cut down on the calories you eat and boost the calories you burn with exercise.

- **Reduce stress.** Simplify your life as much as possible. Learn relaxation techniques. Ask your doctor about help if necessary.



Treatment:

Medication and Supplements

Every patient with CAD can benefit from medication. Since no two patients are alike, your doctor will decide what's best for you. Here are the major options:

- **Supplements.** Most patients with CAD should take fish oil capsules to get 1 gram of omega-3 fats a day. Other vitamins and supplements have not proven helpful, and some may do more harm than good.
- **Anti-clotting drugs.** Aspirin is an important medicine that helps prevent artery-blocking blood clots. All it takes is 81 mg (one “baby aspirin”) a day. Unless there is a specific reason not to take aspirin (such as ulcers, bleeding, or allergies), every patient with CAD should take low-dose aspirin. Your doctor may also prescribe other anti-clotting drugs such as *clopidogrel* or *warfarin* instead of, or in addition to, aspirin.
- **Nitrates.** These medications relax muscles in the walls of arteries, helping to widen the channels. *Nitroglycerin* is the short-acting form used under the tongue in tablets or sprays to relieve angina. Long-acting nitrate pills or patches can be prescribed to prevent angina. Headache and light-headedness are the main side effect. It is important to note that men who use nitrates cannot take pills for erectile dysfunction.
- **Beta blockers.** They act by widening arteries, slowing the heart rate, and lowering the blood pressure. Nearly every patient who has had a heart attack should take a beta-blocker to help prevent repeat attacks. They can also

help prevent angina in patients with stable CAD. Side effects include slow pulse, low blood pressure, wheezing, fatigue, and cold hands and feet.

- **Angiotension-converting enzyme inhibitors (ACEIs) and Angiotensin-receptor blockers (ARBs).** These medications widen arteries and lower blood pressure. They also help the heart heal after heart attacks and protect the kidneys of diabetics. Nearly every patient should take an ACEI after a heart attack. Side effects include cough, low blood pressure and dizziness, and high potassium levels. Doctors may prescribe an ARB for some patients who cannot take an ACEI.
- **Calcium-channel blockers.** These widen arteries and lower blood pressure; some also slow the heart rate. They can help prevent angina, but are less desirable after a heart attack and in patients with impaired heart function. Side effects include dizziness, low blood pressure, fluid retention, and constipation.
- **Cholesterol-lowering drugs.** Patients with mild, stable CAD should lower their LDL (“bad”) cholesterol to 100 mg/dL or less. For patients with unstable or severe CAD, the goal is 70 mg/dL or less. Almost all patients will need medication to achieve these goals. In most cases, it's a *statin* drug. Other helpful medications include *niacin*, the *fibrates*, *ezetimibe*, and the *resins*.

Treatment: *Revascularization*

Although many patients with CAD respond well to lifestyle changes and medication, many others benefit from procedures that restore blood flow to the heart (*revascularization*). It's particularly important in the first few hours after a heart attack, when "clot-busting" drugs can be used if an angioplasty is not available. Aside from such emergencies, two methods are available:

- **Angioplasty.** Cardiologists thread a thin catheter (tube) into the narrowed coronary artery. Once an angiogram (See page 8) shows the catheter is in place, doctors inflate a tiny balloon to compress the plaque and open the artery. In most cases, a fine wire mesh or *stent* is introduced through the catheter and expanded in the diseased area to keep it open. Angioplasties are performed in special cardiac catheter labs without general anesthesia.
- **Coronary artery bypass graft (CABG).** Cardiac surgeons remove a small length of a healthy vein or artery from the patient, then splice it to a coronary artery to shunt blood around the blockage. Several grafts can be performed during the operation, which requires general anesthesia and, in most cases, a heart-lung machine.

Follow a heart-healthy lifestyle, take your medication as directed, and listen to your body.



Reducing Your Risk for the Future

If you have already had a heart attack, you are at greater risk of suffering a second heart attack. It is important to talk to your doctor about a risk reduction plan. Some measures that can be taken to reduce your risk include lifestyle modifications and medications that improve cholesterol, control blood pressure, or limit the formation of blood clots. Take a proactive approach and talk to your doctor today about what options are available to help reduce your risk for a second event.

Living with CAD

CAD is a serious, lifelong illness. Your doctor will educate you on how to live with CAD, but your job is just as important. Follow a heart-healthy lifestyle, take your medication as directed, and listen to your body so you can report symptoms as soon as they occur. It's a lifelong process, but it will help keep the beat of life strong.

For more information about heart disease and CAD, visit:

Notes:



American Heart Association

1-800-AHA-USA1
(1-800-242-8721)

www.americanheart.org



Centers for Disease Control and Prevention *Division of Heart Disease and Stroke Prevention*

1-770-488-2424

www.cdc.gov/dhdsp



National Heart Lung and Blood Institute: *National Institutes of Health*

1-301-592-8573

[www.nhlbi.nih.gov/health/
public/heart/index.htm](http://www.nhlbi.nih.gov/health/public/heart/index.htm)



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HARVARD
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Patient Education Center
2127 Second Avenue North
Fort Dodge, IA 50501
service@patientedu.org

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Consulting Physician: Anthony L. Komaroff, MD
Editorial Director: Keith D'Oria
Creative Director: Jon Nichol

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