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CORONARY ARTERY DISEASE

Heart is a strong muscular pump that is responsible for moving about 3,000 gallons of blood through your body every day. Like other muscles, your heart requires a continuous supply of blood to work properly. Your heart muscle gets the blood it needs to do its job from the coronary arteries

Coronary artery disease (CAD) causes impaired blood flow in the arteries that supply blood to the heart. Also called coronary heart disease (CHD), CAD is the most common form of heart disease and affects approximately 16.5 million Americans over the age of 20.

It's also the leading cause of death for both men and women in the United States. It's estimated that every 40 seconds, someone in the United States has a heart attack.

A heart attack can come from uncontrolled CAD.

What is coronary artery disease?

Coronary artery disease is the narrowing or blockage of the coronary arteries, usually caused by atherosclerosis. Atherosclerosis (sometimes called "hardening" or "clogging" of the arteries) is the buildup of cholesterol and fatty deposits (called plaques) on the inner walls of the arteries. These plaques can restrict blood flow to the heart muscle by physically clogging the artery or by causing abnormal artery tone and function.

Without an adequate blood supply, the heart becomes starved of oxygen and the vital nutrients it needs to work properly. This can cause chest pain called angina. If the blood supply to a portion of the heart muscle is cut off entirely, or if the energy demands of the heart become much greater than its blood supply, a heart attack (injury to the heart muscle) may occur.

Who is affected by coronary artery disease?

Heart disease is the leading cause of death among men and women in the United States. Coronary artery disease affects 16.5 million Americans. The American Heart Association (AHA) estimates that someone in the US has a heart attack about every 40 seconds. In addition, for patients with no risk factors for heart disease, the lifetime risk of having cardiovascular disease is 3.6% for men and less than 1% for women. Having 2 or more risk factors increase the lifetime risk of cardiovascular disease to 37.5% for men and 18.3% in women.

What are acute coronary syndromes?

Unstable angina: This may be a new symptom or a change from stable angina. The angina may occur more frequently, occur more easily at rest, feel more severe, or last longer. Although this can often be relieved with oral medications (such as nitroglycerin), it is unstable and may progress to a heart attack. Usually, more intense medical treatment or a procedure is required to treat unstable angina.

Non-ST segment elevation myocardial infarction (NSTEMI): This type of heart attack, or MI, does not cause major changes on an electrocardiogram (ECG). However, chemical markers in the blood indicate that damage has occurred to the heart muscle. In NSTEMI, the blockage may be partial or temporary, so the extent of the damage

is usually relatively small.

ST segment elevation myocardial infarction (STEMI): This type of heart attack, or MI, is caused by a sudden blockage in blood supply. It affects a large area of the heart muscle and causes changes on the ECG as well as in blood levels of key chemical markers.

Although some people have symptoms that indicate they may soon develop acute coronary syndrome, some may have no symptoms until something happens, and still, others have no symptoms of acute coronary syndrome at all.

All acute coronary syndromes require emergency evaluation and treatment.

Collateral Circulation

As the size of the blockage in a coronary artery increases, the narrowed coronary artery may develop "collateral circulation." Collateral circulation is the development of new blood vessels that reroute blood flow around the blockage. However, during times of increased exertion or stress, the new arteries may not be able to supply enough oxygen-rich blood to the heart muscle.

What is ischemia?

Ischemia is a condition described as "cramping of the heart muscle." Ischemia occurs when the narrowed coronary artery reaches a point where it cannot supply enough oxygen-rich blood to meet the heart's needs. The heart muscle becomes "starved" for oxygen-rich blood to meet the heart's needs. The heart muscle becomes "starved" for oxygen.

Ischemia of the heart can be compared to a cramp in the leg. When someone exercises for a very long time, the muscles in the legs cramp up because they're starved for oxygen and nutrients. Your heart, also a muscle, needs oxygen and nutrients to keep working. If the heart muscle's blood supply is inadequate to meet its needs, ischemia occurs, and you may feel chest pain or other symptoms.

Ischemia is most likely to occur when the heart demands extra oxygen. This is most common during exertion (activity), eating, excitement or stress, or exposure to cold.

When ischemia is relieved in less than 10 minutes with rest or medications, you may be told you have "stable coronary artery disease" or "stable angina." Coronary artery disease can progress to a point where ischemia occurs even at rest.

Ischemia and even a heart attack can occur without any warning signs and is called "silent" ischemia. Silent ischemia can occur among all people with heart disease, though it is more common among people with diabetes.

What are the risk factors for coronary artery disease?

Non-modifiable risk factors (those that cannot be changed) include:

Male gender. Men have a greater risk of heart attack than women do, and men have heart attacks earlier in life than women. However, beginning at age 70, the risk is equal for men and women.

Advanced age. Coronary artery disease is more likely to occur as you get older, especially after Age 65.

Family history of heart disease. You have an increased risk of developing heart disease if you have a parent with a history of heart disease, especially if they were diagnosed before Age 50. Ask your doctor when it's appropriate for you to start screenings for heart disease so it can be detected and treated early.

Race. African Americans have more severe high blood pressure than Caucasians and, therefore, have a higher risk of heart disease. The risk of heart disease is also higher among Mexican Americans, American Indians, native Hawaiians, and some Asian Americans. This is partly due to higher rates of obesity and diabetes in these populations.

Modifiable risk factors (those you can treat or control) include:

Cigarette smoking and exposure to tobacco smoke

High blood cholesterol and high triglycerides – especially high LDL ("bad") cholesterol over 100 mg/dL and low HDL ("good") cholesterol under 40 mg/dL. Some patients who have existing heart or blood vessel disease, and other patients who have a very high risk, should aim for an LDL level less than 70 mg/dL. Your doctor can provide specific guidelines.

High blood pressure (140/90 mmHg or higher)

Uncontrolled diabetes (HbA1c >7.0)

Physical inactivity

Being overweight (body mass index [BMI] 25–29 kg/m2) or being obese (BMI higher than 30 kg/m2)

NOTE: How your weight is distributed is important. Your waist measurement is one way to determine fat distribution. Your waist circumference is the measurement of your waist, just above your navel. The risk of cardiovascular disease increases with a waist measurement of over 35 inches in women and over 40 inches in men.

Uncontrolled stress or anger

Unhealthy Diet

The more risk factors you have, the greater your risk of developing coronary artery disease.

What causes the coronary arteries to narrow?

Your coronary arteries are shaped like hollow tubes through which blood can flow freely. The muscular walls of the coronary arteries are normally smooth and elastic and are lined with a layer of cells called the endothelium. The endothelium provides a physical barrier between the blood stream and the coronary artery walls, while regulating the function of the artery by releasing chemical signals in response to various stimuli.

Coronary artery disease starts when you are very young. Before your teen years, the blood vessel walls begin to show streaks of fat. As you get older, the fat builds up, causing slight injury to your blood vessel walls. Other substances traveling through your blood stream, such as inflammatory cells, cellular waste products, proteins and calcium begin to stick to the vessel walls. The fat and other substances combine to form a material called plaque.

Over time, the inside of the arteries develop plaques of different sizes. Many of the plaque deposits are soft on the inside with a hard fibrous "cap" covering the outside. If the hard surface cracks or tears, the soft, fatty inside is exposed. Platelets (disc-shaped particles in the blood that aid clotting) come to the area, and blood clots form around the plaque. The endothelium can also become irritated and fail to function properly, causing the muscular artery to squeeze at inappropriate times. This causes the artery to narrow even more.

Sometimes, the blood clot breaks apart, and blood supply is restored. In other cases, the blood clot (coronary thrombus) may suddenly block the blood supply to the heart muscle (coronary occlusion), causing one of three serious conditions, called acute coronary syndromes.

Diagnosis

The doctor will ask questions about your medical history, do a physical exam and order routine blood tests. He or she may suggest one or more diagnostic tests as well, including:

Electrocardiogram (ECG). An electrocardiogram records electrical signals as they travel through your heart. An ECG can often reveal evidence of a previous heart attack or one that's in progress.

In other cases, **Holter monitoring** may be recommended. With this type of ECG, you wear a portable monitor for 24 hours as you go about your normal activities. Certain abnormalities may indicate inadequate blood flow to your heart.

Echocardiogram. An echocardiogram uses sound waves to produce images of your heart. During an echocardiogram, your doctor can determine whether all parts of the heart wall are contributing normally to your heart's pumping activity.

Parts that move weakly may have been damaged during a heart attack or be receiving too little oxygen. This may indicate coronary artery disease or various other conditions.

Stress test. If your signs and symptoms occur most often during exercise, your doctor may ask you to walk on a treadmill or ride a stationary bike during an ECG. This is known as an exercise stress test. In some cases, medication to stimulate your heart may be used instead of exercise.

Some stress tests are done using an echocardiogram. For example, your doctor may do an ultrasound before and after you exercise on a treadmill or bike. Or your doctor may use medication to stimulate your heart during an echocardiogram.

Doctors may also use medications to stimulate your heart during an MRI. Doctors may use this imaging test to evaluate you for coronary artery disease.

Another stress test known as **a nuclear stress test** helps measure blood flow to your heart muscle at rest and during stress. It's similar to a routine exercise stress test but with images in addition to an ECG. A tracer is injected into your bloodstream, and special cameras can detect areas in your heart that receive less blood flow.

Cardiac catheterization and angiogram. To view blood flow through your heart, your doctor may inject a special dye into your coronary arteries. This is known as an angiogram. The dye is injected into the arteries of the heart through a long, thin, flexible tube (catheter) that is threaded through an artery, usually in the leg, to the arteries in the heart.

This procedure is called cardiac catheterization. The dye outlines narrow spots and blockages on the X-ray

images. If you have a blockage that requires treatment, a balloon can be pushed through the catheter and inflated to improve the blood flow in your coronary arteries. A mesh tube (stent) may then be used to keep the dilated artery open.

Heart scan**. Computerized tomography (CT)** technologies can help your doctor see calcium deposits in your arteries that can narrow the arteries. If a substantial amount of calcium is discovered, coronary artery disease may be likely.

A **CT coronary angiogram**, in which you receive a contrast dye injected intravenously during a CT scan, also can generate images of your heart arteries.

Treatment

Treatment for coronary artery disease usually involves lifestyle changes and, if necessary, drugs and certain medical procedures.

Lifestyle changes

Making a commitment to the following healthy lifestyle changes can go a long way toward promoting healthier arteries:

Quit smoking.

Eat healthy foods.

Exercise regularly.

Lose excess weight.

Reduce stress.

Drugs

Various drugs can be used to treat coronary artery disease, including:

Cholesterol-modifying medications. By decreasing the amount of cholesterol in the blood, especially low-density lipoprotein (LDL, or the "bad") cholesterol, these drugs decrease the primary material that deposits on the coronary arteries. Your doctor can choose from a range of medications, **including statins, niacin, fibrates and bile acid sequestrants.**

Aspirin. Your doctor may recommend taking a daily aspirin or other blood thinner. This can reduce the tendency of your blood to clot, which may help prevent obstruction of your coronary arteries.

If you've had a heart attack, aspirin can help prevent future attacks. There are some cases where aspirin isn't appropriate, such as if you have a bleeding disorder or you're already taking another blood thinner, so ask your doctor before starting to take aspirin.

Beta blockers. These drugs slow your heart rate and decrease your blood pressure, which decreases your heart's demand for oxygen. If you've had a heart attack, beta blockers reduce the risk of future attacks.

Calcium channel blockers. These drugs may be used with beta blockers if beta blockers alone aren't effective or instead of beta blockers if you're not able to take them. These drugs can help improve symptoms of chest pain.

Ranolazine. This medication may help people with chest pain (angina). It may be prescribed with a beta blocker or instead of a beta blocker if you can't take it.

Nitroglycerin. Nitroglycerin tablets, sprays and patches can control chest pain by temporarily dilating your coronary arteries and reducing your heart's demand for blood.

Angiotensin-converting enzyme (ACE) inhibitors and angiotensin II receptor blockers (ARBs). These similar drugs decrease blood pressure and may help prevent progression of coronary artery disease.

Procedures to restore and improve blood flow

Coronary artery stent

Coronary bypass surgery

Sometimes more aggressive treatment is needed. Here are some options:

Angioplasty and stent placement (percutaneous coronary revascularization)

Your doctor inserts a long, thin tube (catheter) into the narrowed part of your artery. A wire with a deflated balloon is passed through the catheter to the narrowed area. The balloon is then inflated, compressing the deposits against your artery walls.

A stent is often left in the artery to help keep the artery open. Most stents slowly release medication to help keep the arteries open.

Coronary artery bypass surgery

A surgeon creates a graft to bypass blocked coronary arteries using a vessel from another part of your body. This allows blood to flow around the blocked or narrowed coronary artery. Because this requires open-heart surgery, it's most often reserved for cases of multiple narrowed coronary arteries.

Lifestyle and home remedies

Lifestyle changes can help you prevent or slow the progression of coronary artery disease.

Stop smoking. Smoking is a major risk factor for coronary artery disease. Nicotine constricts blood vessels and forces your heart to work harder, and carbon monoxide reduces oxygen in your blood and damages the lining of your blood vessels. If you smoke, quitting is one of the best ways to reduce your risk of a heart attack.

Control your blood pressure. Ask your doctor for a blood pressure measurement at least every two years. He or she may recommend more-frequent measurements if your blood pressure is higher than normal or you have a history of heart disease. Optimal blood pressure is less than 120 systolic and 80 diastolic, as measured in millimeters of mercury (mm Hg).

Check your cholesterol. Ask your doctor for a baseline cholesterol test when you're in your 20s and at least every five years. Most people should aim for an LDL cholesterol level below 130 milligrams per deciliter (mg/dL), or 3.4 millimoles per liter (mmol/L) If you have other risk factors for heart disease, your target LDL cholesterol may

be below 100 mg/dL (2.6 mmol/L).

Keep diabetes under controlI. f you have diabetes, tight blood sugar management can help reduce the risk of heart disease.

. **Exercise** helps you achieve and maintain a healthy weight and control diabetes, elevated cholesterol and high blood pressure — all risk factors for coronary artery disease. For example, try walking for about 30 minutes on most or all days of the week.

Participate in cardiac rehabilitation. If you've had surgery, your doctor may suggest you participate in cardiac rehabilitation — a program of education, counseling and exercise training that's designed to help improve your health.

Eat healthy foods. A heart-healthy diet, such as the Mediterranean diet, that emphasizes plant-based foods, such as fruits, vegetables, whole grains, legumes and nuts — and is low in saturated fat, cholesterol and sodium — can help you control your weight, blood pressure and cholesterol. Eating one or two servings of fish a week also is beneficial.

Avoid saturated fat and trans fat, excess salt, and excess sugar. If you drink alcohol, drink it in moderation — this means up to one drink a day for women of all ages and men older than age 65, and up to two drinks a day for men age 65 and younger. One drink equals 12 ounces of beer, 5 ounces of wine or 1.5 ounces of 80-proof liquor.

Maintain a healthy weight. Being overweight increases your risk of coronary artery disease. Losing even just a small percentage of your current weight can help reduce risk factors for coronary artery disease.

Manage stress. Reduce stress as much as possible. Practice healthy techniques for managing stress, such as muscle relaxation and deep breathing.

Get your flu shot. Get your flu (influenza) vaccine each year to reduce your risk of having influenza.

In addition to healthy lifestyle changes, remember the importance of **regular medical checkups.** Some of the main risk factors for coronary artery disease — high `cholesterol, high blood pressure and diabetes — have no symptoms in the early stages. Early detection and treatment can set the stage for a lifetime of better heart health.

Alternative medicine

Omega-3 fatty acids are a type of unsaturated fatty acid that's thought to reduce inflammation throughout the body, a contributing factor to coronary artery disease. However, some research has not found them to be beneficial. More research is needed.

Fish and fish oil. Fish and fish oil are the most effective sources of omega-3 fatty acids. Fatty fish — such as salmon, herring and light canned tuna — contain the most omega-3 fatty acids and, therefore, the most benefit. Fish oil supplements may offer benefit, but the evidence is strongest for eating fish.

Flax and flaxseed oil. Flax and flaxseed oil also contain beneficial omega-3 fatty acids, though studies have not found these sources to be as effective as fish. The shells on raw flaxseeds also contain soluble fiber, which can help with constipation. More research is needed to determine if flaxseed can help lower blood cholesterol.

Other dietary sources of omega-3 fatty acids. Other dietary sources of omega-3 fatty acids include canola oil, soybeans and soybean oil. These foods contain smaller amounts of omega-3 fatty acids than do fish and fish oil,

and evidence for their benefit to heart health isn't as strong.

Other supplements may help reduce your blood pressure or cholesterol level, two contributing factors to coronary artery disease. These include:

Alpha-linolenic acid (ALA)

Artichoke

Barley

Beta-sitosterol (found in oral supplements and some margarines, such as Promise Activ)

Blond psyllium

Cocoa

Coenzyme Q10

Garlic

Oat bran (found in oatmeal and whole oats)

Sitostanol (found in oral supplements and some margarines, such as Benecol)

Preparing for your appointment

Early-stage coronary artery disease often produces no symptoms, so you may not discover you're at risk of the condition until a routine checkup reveals you have high cholesterol or high blood pressure. So it's important to have regular checkups.

If you know you have symptoms of or risk factors for coronary artery disease, you're likely to see your primary care doctor or a general practitioner. Eventually, however, you may be referred toheart specialist (cardiologist).