



## Health & Wellness Institute

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### Cardiovascular Disease Fact Sheet

**Also Listed As:** Arteries, Hardening of; Arteriosclerosis; Coronary Artery Disease

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Atherosclerosis is a slow, complex disease in which fatty substances, cholesterol, cellular waste products, calcium, and other substances build up in the inner lining of an artery. This buildup is called plaque. Atherosclerosis is derived from the Greek words athero (meaning gruel or paste) and sclerosis (meaning hardness). The effects of atherosclerosis differ depending upon which arteries in the body narrow and become clogged with plaque. For example, plaque buildup in the vessels that supply the heart with oxygen-rich blood may cause chest pain and lead to a heart attack while plaque buildup in the arteries that supply blood to the brain may result in a stroke.

According to the Centers for Disease Control, heart disease is the leading cause of illness and death in the United States and most other Western countries. Close to one million deaths per year in the United States alone are attributable to heart disease, double the number of deaths from cancer. Because atherosclerosis is highly preventable and the risk factors are well-documented, preventive measures such as lowering blood pressure and LDL ("bad") cholesterol levels, smoking cessation, losing weight, and increasing physical activity should be followed.

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### Signs and Symptoms

Atherosclerosis shows no symptoms until a significant percentage (40%) of a vessel becomes obstructed with plaque and a complication occurs. Symptoms vary depending upon which arteries in the body narrow and become clogged with plaque.

### **Coronary Artery Disease (CAD)**

CAD is caused by plaque buildup in the vessels that supply the heart with oxygen-rich blood. When the tissues of the heart begin to become deprived of oxygen (ischemia), chest pain (angina) occurs. If the artery becomes completely blocked, cells in the heart begin to die and a heart attack may occur. Symptoms of CAD are usually triggered by physical exercise, sexual activity, exposure to cold weather, anger, or stress. The most common symptoms of CAD include:

- Chest pain (generally a heavy, squeezing, or crushing sensation with possible burning or stabbing pains)
- Abdominal, neck, back, jaw, or shoulder/arm pain
- Nausea and vomiting
- Unexplainable fatigue and/or extreme fatigue after physical activity
- Weakness
- Perspiration
- Shortness of breath
- Depression and/or anxiety

### **Cerebrovascular Disease**

Cerebrovascular disease is caused by plaque buildup in the arteries that supply the brain with oxygen-rich blood. Cerebrovascular disease causes transient ischemic attack (a sudden loss of brain function with complete recovery within 24 hours) and stroke. Symptoms may include:

- Weakness or paralysis on one side of the body
- Garbled speech and/or inability to comprehend speech
- Loss of vision in one eye
- Paralysis of facial muscles
- Muscle weakness
- Impaired senses
- Stupor
- Poor coordination
- Involuntary, jerky movements on one side of the body
- Rapid, repetitive, involuntary eye movement
- Vertigo

### **Peripheral Artery Disease**

Peripheral artery disease is caused by plaque buildup in the arteries that supply the extremities of the body (such as the hands and feet) with oxygen-rich blood. Symptoms may include:

- Pain, aching, cramps, numbness or sense of fatigue in the muscles of the lower extremities
- Diminished pulses in the extremities
- Decreased muscle mass
- "Bruits" (blowing sounds that the physician hears with a stethoscope that indicates turbulence in blood flow)
- Hair loss
- Thickened nails
- Smooth, shiny skin surface
- Skin that is cold to the touch
- Gangrene

## Causes

Many researchers believe that atherosclerosis is caused by damage to the innermost layer of the artery known as the endothelium. High blood pressure, elevated LDL ("bad") cholesterol, an abnormal accumulation of homocysteine (an amino acid produced by the human body), tobacco smoke, diabetes, hormonal changes following menopause, and infection are all thought to contribute to endothelial damage. Once the endothelium is damaged, it becomes easier for fats, cholesterol, cellular waste products, calcium, and other substances to become deposited in the artery wall. This buildup thickens the endothelium significantly. As a result, the diameter of the artery shrinks, blood flow decreases, and oxygen supply is dramatically reduced. Blood clots may also form on top of the plaque or damaged endothelium, thereby blocking the artery, and completely cutting off blood supply.

Because many people do not have the classic risk factors of atherosclerosis (such as cigarette smoking and high blood pressure), it is possible that there may be other contributing factors or causes of atherosclerosis, such as inflammation from an infection or autoimmune disease.

## Risk Factors

- Male gender
- Lowered levels of the hormone estrogen following menopause
- Older age
- High blood pressure
- High LDL ("bad") cholesterol and/or high triglycerides
- Elevated homocysteine levels
- Low HDL ("good") cholesterol
- Family history of atherosclerosis (which may be related to learned behavior rather than genetic factors)
- Cigarette smoking and regular exposure to second-hand smoke
- Diabetes mellitus
- Insulin resistance
- Obesity, particularly in the abdominal region
- Sedentary lifestyle
- Diets high in saturated fat and trans fatty acids
- Stress
- Depression

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## Diagnosis

A healthcare practitioner can determine your risk for heart disease by conducting a variety of tests. Blood tests detect elevated levels of cholesterol, homocysteine, and blood clotting factors. A stress test (otherwise known as an exercise tolerance test) monitors heart rate and blood pressure while an individual walks on a treadmill or rides a stationary bicycle. An electrocardiogram (ECG) is used during a stress test to measure and record the electrical activity of the heart. ECGs can detect abnormal heart rhythms, scar formation in the heart muscle from a prior heart attack, and areas of decreased blood flow when the heart is strained (as with physical activity). Advanced imaging techniques used during a stress test (such as an ultrasound) can determine precise areas of decreased blood flow to the heart. Angiograms (or angiography) can reveal arterial damage and plaque buildup.

## Preventive Care

Making careful lifestyle choices is an important first step in preventing atherosclerosis. Some healthy habits include:

- Achieving and maintaining normal weight
- Controlling high blood pressure, high cholesterol, diabetes, and other disorders that may contribute to the buildup of plaque in arteries
- Avoiding cigarette smoking and second-hand smoke
- Eating a diet low in saturated and hydrogenated fats and cholesterol, and high in starches, fiber, fruits, and vegetables
- Exercising 3 hours per week or more (such as 30 minutes per day, 6 days per week)
- Reducing stress

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## Treatment Approach

Atherosclerosis shows no symptoms until a complication (such as chest pain or a heart attack) occurs. For this reason, lifestyle choices such as achieving and maintaining a normal weight, lowering blood pressure and cholesterol, exercising regularly, quitting smoking, and reducing stress, are all important steps in preventing atherosclerosis. Once a complication occurs, however, surgery and other Procedures may be required to remove plaque from clogged arteries or to create a detour around a blocked artery. Medications are often prescribed to lower cholesterol or blood pressure and to prevent an initial or recurrent complication. Healthy diets designed to lower cholesterol, blood pressure, and excess body weight are essential in the treatment of atherosclerosis. Nutrition and dietary supplements, such as vitamin E, omega-3 fatty acids, and folate (vitamin B9) may be effective when used in addition to certain medications. Herbs, such as hawthorn, have also shown promise in lowering cholesterol levels and reducing the risk of heart disease.

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## Medications

### Cholesterol-Lowering Drugs

The following medications are used to prevent development of atherosclerosis and to reduce recurrent complications such as heart attack and stroke in those with the condition.

- Statins (such as lovastatin, pravastatin, simvastatin, atorvastatin, and fluvastatin)
- Niacin
- Bile acid sequestrants (such as cholestyramine, colestipol, and colesevelam)
- Fibric acid derivatives (such as gemfibrozil, fenofibrate, and clofibrate)
- Probuchol

### Blood Pressure Lowering Drugs

- The following medications are used to control blood pressure, prevent development of atherosclerosis, and slow the progression of the disease. They are also used to lower heart rate, thereby reducing the work load or strain on the heart.
- Beta-blockers (such as acebutolol, atenolol, metoprolol, nadolol, and propranolol)
- Angiotensin-converting enzyme (ACE) inhibitors (such as benazepril, captopril, enalapril, lisinopril, and ramipril)
- Calcium-channel blockers (such as amlodipine, felodipine, nifedipine, nicardipine, and verapamil)
- Alpha/beta blockers (such as labetalol)

### Blood Thinning Drugs, Platelet Inhibitors

- Aspirin—first choice platelet inhibitor for preventing and treating atherosclerosis; reduces risk of transient ischemic attack (TIA), stroke, and heart attacks
- Ticlopidine—for individuals who can not take aspirin (due to allergies, for example) or do not

- improve from aspirin; has more side effects than aspirin
- Dipyridamole—not as effective as aspirin when used alone but may be used in combination with aspirin or warfarin (another blood thinner); often used after bypass surgery
- Clopidogrel—reduces risk of heart attacks
- Glycoprotein IIb/IIIa receptor agonists (such as abciximab, eptifibatide, lamifiban, and tirofiban)—used when awaiting or just following an angioplasty

### **Blood Thinning Drugs, Anticoagulants**

- Heparin—used intravenously in the hospital following a TIA, stroke, or heart attack
- Low molecular weight heparin—administered by self-injection following a stroke or for coronary artery disease
- Warfarin—used to prevent stroke in individuals who have irregular heart rhythms

### **Blood Thinning Drugs, Thrombolytics**

The following medications are used in the hospital just after a heart attack. They are most effective when used within three hours of a stroke or heart attack.

- Recombinant Tissue Plasminogen Activator (rTPA)
- Streptokinase
- Urokinase

### **Other Medications**

- Nitrates—used to relax the vessels that supply the heart with blood; these medications reduce chest pain
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## **Surgery and Other Procedures**

An angiography (an X-ray examination of blood vessels) is often performed to determine whether a surgical or other procedure is necessary. In the case of atherosclerosis, this test is performed to examine blood vessels in a particular location such as the heart, brain, or lower extremities. Several different procedures (surgical and non-surgical) may be performed depending upon the location and severity of atherosclerosis

### **Non-surgical techniques**

The following nonoperative techniques may be performed on individuals with coronary and peripheral artery disease:

- Angioplasty—a procedure used to widen narrowed arteries. A surgeon inserts a catheter with a deflated balloon into the narrowed part of the artery. The balloon is inflated, widening the inner diameter of the blood vessel so blood can flow more easily. The balloon is then deflated and the catheter is removed. This procedure may also include the placement of a permanent stent (wire mesh) that holds the artery open and improves blood flow. Angioplasty with stent placement is considered the safest and most effective procedure for atherosclerosis.
- Atherectomy—a procedure to remove plaque from the arteries using a laser catheter or a rotating shaver
- Laser revascularization—a procedure in which a laser creates multiple channels through the heart muscle into the main pumping chamber of the heart. These channels fill with blood from the pumping chamber which then supplies oxygen and needed nutrients to the heart muscle. It is used to relieve severe chest pain in individuals who have no other treatment options.

### **Surgical Procedures**

- Bypass surgery—a procedure that reroutes or bypasses blood around clogged arteries to improve blood supply to affected areas such as the heart or the lower extremities
- Minimally invasive bypass surgery—this procedure creates a small incision rather than the broad opening in the chest wall created during regular bypass surgery
- Endarterectomy—a procedure primarily used to remove plaque in the carotid (a major artery located in the front of the neck) or peripheral arteries

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## Nutrition and Dietary Supplements

Healthy eating habits can help reduce high blood cholesterol, high blood pressure, and excess body weight -- three of the major risk factors for heart disease. The American Heart Association (AHA) has developed dietary guidelines that help lower fat and cholesterol intake and reduce the risk of heart disease. The main goal of these guidelines is to promote an overall healthy eating pattern, maintain an appropriate body weight, and reach desirable cholesterol and blood pressure levels. The AHA does not recommend very low-fat diets as these diets may lead to deprivation of essential fatty acids as well as an undesired reduction in HDL ("good") cholesterol levels. The AHA also advises against high-protein diets due to the lack of scientific evidence supporting their weight-loss effectiveness or any other claims of health benefits. In general, Western diets are considered to be too high in protein, particularly animal protein (which is high in fat and cholesterol). In adults, high levels of protein can cause kidney damage and bone loss.

The AHA recommends the following to prevent the development or progression of atherosclerosis:

- A variety of fruits and vegetables (5 to 9 servings/day)
- A variety of grain products, with an emphasis on whole grains (6 or more servings/day)
- At least 2 servings of fish per week
- Limit total fat intake to <30% and saturated fat to <10% of energy. Replace dietary saturated fats and trans fatty acids with monounsaturated and polyunsaturated fats (including foods rich in omega-3 fatty acids). Food sources of omega-3 fatty acids include fatty fish (such as salmon), flaxseed and flaxseed oil, soybean oil, canola oil, and nuts.
- Limit dairy products to low-fat or fat free items (2 to 4 servings/day)
- Limit sodium intake to 6 grams per day
- Limit alcohol intake to 2 drinks/day for men and 1 drink/day for women
- Maintain a healthy body weight by matching calorie intake to energy needs; this includes a moderate level of regular physical activity (30 to 60 minutes within target heart range most days per week)

In addition to the recommendations listed above, the AHA suggests that individuals who have heart disease or are at a high risk of developing heart disease consider the more specialized diets below:

### Diets for People with High Cholesterol

The National Cholesterol Education Program (NCEP) recommends saturated fat intake of no more than 7% of total calories, cholesterol limited to less than 200 mg/day, little to no trans fatty acids (such as fried foods), intake of both plant stanols/sterols (2 grams/day) and soluble fiber (10 to 25 grams/day), weight loss, and exercise. Studies have also shown that replacing dietary animal protein with soy protein may reduce total cholesterol, LDL ("bad") cholesterol, and triglycerides (a major form of fat in the blood) without affecting HDL ("good") cholesterol levels. The AHA also recommends a diet high in unsaturated fat rather than a very low-fat diet for individuals with atherogenic dyslipidemia (a condition marked by high triglycerides, low HDL cholesterol, obesity, high blood pressure, and/or diabetes).

### Diets for People with High Blood Pressure

The Dietary Approaches to Stop Hypertension (DASH) diet emphasizes a diet rich in fruits, vegetables, and low-fat or non-fat dairy products to provide high intake of potassium, magnesium, and calcium sources. Sodium intake should be less than 6 g/day. Weight loss, regular physical activity, and limiting of alcohol intake are also very important factors for lowering blood pressure.

### Mediterranean Diet

The Mediterranean Style Diet is comprised of whole grains, fresh fruits and vegetables, fish, olive oil, and moderate, daily wine consumption. Unlike the AHA diets, the Mediterranean Style Diet is not low in all fats; it is low in saturated fat but high in monounsaturated fatty acids. In a long-term study of 423 patients who suffered a heart attack, those who followed a Mediterranean Style Diet had a 50% to 70% lower risk of

recurrent heart disease compared with controls who received no special dietary counseling. The intervention diet emphasized bread, root and green vegetables, daily intake of fruit, fish and poultry, olive and canola oils, margarine high in alpha-linolenic acid (an omega-3 polyunsaturated fatty acid found in flaxseed, walnuts, and canola oil), along with discouragement of ingestion of red meat and total avoidance of butter and cream.

## **Supplements and Vitamins**

### **Folic Acid, Vitamin B6, Vitamin B12, Betaine**

Many studies indicate that patients with elevated levels of the amino acid homocysteine are roughly 1.7 times more likely to develop coronary artery disease and 2.5 times more likely to suffer from a stroke than those with normal levels. Homocysteine levels are strongly influenced by dietary factors, particularly vitamin B9 (folic acid), vitamin B6, vitamin B12, and betaine. These substances help break down homocysteine in the body. Some studies have even shown that healthy individuals who consume higher amounts of folic acid and vitamin B6 are less likely to develop atherosclerosis than those who consume lower amounts of these substances. Despite these findings, the AHA reports that there is insufficient evidence to suggest that supplementation with betaine and B vitamins reduce the risk of atherosclerosis or that taking these supplements prevents the development or recurrence of heart disease. The AHA does not currently recommend population-wide homocysteine screening, and suggests that folic acid, as well as vitamin B6, B12, and betaine requirements be met through diet alone. Individuals at high risk for developing atherosclerosis however, should be screened for blood levels of homocysteine. If elevated levels are detected, a healthcare practitioner may recommend supplementation.

### **Omega-3 Fatty Acids**

There is strong evidence that omega-3 fatty acids (namely EPA and DHA) found in fish oil can help prevent and treat atherosclerosis by inhibiting the development of plaques and blood clots. In one study of 223 patients with coronary artery disease, those who received fish oil supplements daily for 2 years demonstrated a significant improvement in symptoms compared to those who did not receive the supplements. A second study of heart attack survivors found that daily supplementation with omega-3 fatty acids dramatically reduced the rate of death, subsequent heart attacks, and stroke.

### **L-Carnitine**

Studies suggest that patients who take L-carnitine supplementation soon after suffering a heart attack may be less likely to suffer a subsequent heart attack, die of heart disease, and experience chest pain and abnormal heart rhythms. In addition, people with coronary artery disease who use L-carnitine along with standard medication may be able to sustain physical activity for longer periods of time.

### **Antioxidants**

Evidence suggests that antioxidants may play a role in the prevention of atherosclerosis. Antioxidants are believed to prevent fatty buildup in the arteries by suppressing the oxidation of LDL ("bad") cholesterol. They may also reduce the likelihood of blood clot formation and may help relax blood vessels thereby improving blood flow. Currently, however, combined data from epidemiologic studies and clinical trials do not provide convincing evidence for the benefits of antioxidant supplementation, as opposed to intake from dietary sources.

### **Vitamin E**

Population-based studies suggest that vitamin E supplements may help prevent the development and progression of heart disease. Several recent well-designed, large-scale studies comparing vitamin E to placebo, however, have not confirmed these findings. More research is currently underway to determine whether vitamin E helps protect against atherosclerosis.

### **Vitamin C**

A few studies suggest that consuming high levels of vitamin C may protect against heart disease, but not all studies confirm this relationship. It is recommended that people who have low levels of this nutrient should

take vitamin C (either through diet or supplements) to prevent atherosclerosis and its complications.

### **Beta-carotene and other carotenoids**

Despite beliefs by the scientific community and the general public, beta-carotene does not appear to protect against atherosclerosis and may even increase the risk of atherosclerosis complications in people who smoke. There is some preliminary evidence, however, that other carotenoids (such as lutein and zeaxanthin), particularly from dietary sources, may prevent plaque buildup in carotid blood vessels. More research is needed to determine whether these carotenoids may be helpful in the prevention of atherosclerosis.

### **Selenium**

Low blood levels of this antioxidant may worsen atherosclerosis. Cigarette smoking and alcohol ingestion are believed to contribute to selenium deficiency. It is not known, however, whether selenium supplementation has any influence on the development or progression of atherosclerosis.

### **Coenzyme Q10 (CoQ10)**

Researchers believe that CoQ10 inhibits blood clot formation and boosts levels of antioxidants. One study found that people who received daily CoQ10 supplements within 3 days of a heart attack were significantly less likely to experience subsequent heart attacks and chest pain and were also less likely to die of the condition than those who did not receive the supplements.

### **Flavonoids**

Test tube, animal, and some population-based studies suggest that the flavonoids quercetin, resveritrol, and catechins (all found in high concentration in red wine) may help reduce the risk of atherosclerosis. By acting as antioxidants, these nutrients appear to protect against the damage caused by LDL cholesterol. Rigorous studies in humans are needed to confirm these findings.

### **Vitamin D**

Low levels of vitamin D may increase the risk of calcium build-up in the arteries, a significant component of atherosclerotic plaque. Atherosclerotic plaque build up in blood vessels can lead to a heart attack or stroke. More research is needed to understand the practical implications of this possible relationship between low vitamin D levels and atherosclerosis.

### **Melatonin**

Low levels of melatonin in the blood have been associated with heart disease, but it is not clear, whether melatonin levels are low in response to having heart disease or if low levels of melatonin predispose people to developing this condition. In addition, several studies in rats suggest that melatonin may protect the hearts of these animals from the damaging effects of ischemia. It is not known from this information, however, whether melatonin supplements may help prevent or treat heart disease in people. More research and scientific information is needed before conclusions can be drawn.

### **Other Nutrients**

Other important biochemical nutrients include Lipoic Acid, Policosinol and ProArginine is also an amino acid that should be considered as an essential part of a complete cardiovascular wellness plan.

### **Herbs**

**Hawthorn** (*Crataegus monogyna*): Used traditionally as a remedy for cardiovascular diseases. Animal and laboratory studies demonstrate that this herb has antioxidant properties that help protect against the formation of plaques and may help control high cholesterol and high blood pressure.

**Garlic** (*Allium sativum*): Clinical trials have shown that fresh garlic and garlic supplements may lower cholesterol levels, prevent blood clots, and destroy plaque.

**Green Tea** (*Camellia sinensis*): Population studies indicate that the antioxidant properties of green tea may prevent atherosclerosis, particularly coronary artery disease.

**Gugulipid** (*Commiphora mukul*): Used in Ayurvedic medicine to treat high cholesterol levels. Certain ingredients in this herbal remedy may have antioxidant properties and may therefore convey health benefits similar to hawthorn, garlic, and green tea.

**Pseudo ginseng root/notoginseng root** (*Panax notoginseng*): Used in Traditional Chinese Medicine to treat chest pain and coronary artery disease. Laboratory studies suggest this herb may help prevent blood clots and protect against the formation of plaques.

## Acupuncture

Acupuncture may be particularly useful for reducing risk factors for heart disease. It is considered an excellent treatment for people who wish to quit smoking and some studies indicate that it may aid in weight loss as well as cholesterol and blood pressure reduction.

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## Homeopathy

Although few studies have examined the effectiveness of specific homeopathic remedies, professional homeopaths would recommend appropriate treatments to reduce the risk of atherosclerosis based on their knowledge and experience. Homeopathic prescriptions for atherosclerosis would include remedies to lower high blood pressure and cholesterol. Before prescribing a remedy, homeopaths take into account a person's constitutional type. In homeopathic terms, a person's constitution is his or her physical, emotional, and intellectual makeup. An experienced homeopath would assess all of these factors when determining the most appropriate remedy for each individual.

## Massage and Physical Therapy

Although few studies have examined the effectiveness of massage therapy on atherosclerosis, massage has a relaxing effect and it has been shown to reduce stress-related hormone levels. Lowering stress hormone levels positively influences cholesterol and blood pressure and may therefore reduce the risk of heart disease. In addition, relaxation techniques may help individuals comply with habits necessary to reduce risk of atherosclerosis, such as dieting, quitting smoking, and exercising. Also, at least one study has found that massage can lower blood pressure.

## Other Considerations

### Prognosis and Complications

Some complications of atherosclerosis include:

- Coronary artery disease
- Heart failure which leads to fluid buildup in the lungs and legs
- Abnormal heart rhythms
- Stroke
- Heart attack
- Inadequate blood supply to certain parts of the body (such as the lower limbs or gastrointestinal tract)
- Kidney failure
- Death

The outlook for atherosclerosis varies from person to person. Atherosclerosis is a progressive disease that frequently leads to complications. It is important for individuals with atherosclerosis to work closely with their healthcare practitioners to ensure that they receive the most appropriate treatments for their condition. Such

care will enable individuals to prevent and lower their risk of suffering recurrent complications.

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## Supporting Therapy and Research References

### Supporting Therapy

Consideration should be given for intravenous cardiovascular nutrition support. Formerly known as chelation therapy, intravenous nutrition using vitamins, minerals and antioxidants is significantly beneficial in lowering risk values. These risk values are known as cardiovascular lab markers which include, **High Sensitive CRP, Homocysteine, Lipids, Thyroid Panel, Folate, Vitamin B12 and B6 levels**, etc. A series of about 25 treatments should be considered. Initial baseline lab values are necessary and then monitoring after several (10 sessions) should be followed.

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