

## Cardiovascular Diseases, Protection and Treatment

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**Abstract:** Heart is the flowing center of the blood. As the number one killer in the world, cardiovascular diseases cause 12 million deaths in the world each year. Male mortality fell by more than 60 percent in Japan, and by 50 percent or so in Australia, Canada, France and the United States. The average rates of hospital discharges in the European Union were 2,190,000 for cardiovascular disease; 629,000 for coronary heart disease; and 356,000 for stroke. These data are for the latest year available. In Africa, Western Asia and Southeast Asia, 15-20 percent of the estimated 20 million annual deaths are due to cardiovascular diseases. This translates to 3 to 4 million deaths, bringing the total for developing countries to 8 or 9 million, or about 70 percent more than that for developed countries. This article is giving a brief description of the cardiovascular diseases as the references to the scientists and the normal people. [Nature and Science. 2006;4(4):68-78].

**Keywords:** artery; blood; cardiovascular diseases; heart; vein

### 1. Cardiovascular Disease in the World

Heart is the flowing center of the blood that offers the whole animal body for the nutrition and oxygen needed. The vascular system including arteries and veins take the task to flow the blood through the animal body and heart is the pump as the blood flowing energy resource. The health condition is significant important for any person.

More than 50 million Americans alone display blood pressures considered outside the safe physiological range (Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure.1997. *Arch. Intern. Med.* 157(21):2413-46).

Cardiovascular diseases cause 12 million deaths in the world each year, according to the third monitoring report of the World Health Organization, 1991--93. They cause half of all deaths in several developed countries, and are one of the main causes of death in many developing countries - and the major cause of death in adults. Many cardiovascular events aren't fatal but may be sufficiently debilitating to seriously affect functional ability. This is hard to assess without reliable morbidity data, but it may well be that 25 - 30 percent of the cardiovascular disease burden arises from disabling sequelae of stroke or other forms of heart disease.

Significant declines are recorded for total cardiovascular disease mortality as well as specific cardiovascular diseases over the last few decades. Male mortality fell by more than 60 percent in Japan, and by 50 percent or so in Australia, Canada, France and the United States. A similar pattern is seen for females.

Less impressive declines (20--25 percent) in cardiovascular disease mortality have been recorded for the Scandinavian countries, as well as Ireland, Portugal and Spain.

Cardiovascular disease death rates have risen by 40 percent in Hungary and the former Czechoslovakia, by almost 60 percent in Poland and by almost 80 percent in Bulgaria. These rates reflect massive increases in adult male mortality.

In both developed and developing countries, deaths from cardiovascular disease still account for almost 50 percent of all deaths. In the third monitoring report of the World Health Organization, 1991--93, it was stated that cardiovascular diseases are the principal cause of mortality in Europe, accounting for more than 50 percent of all deaths in those older than age 65. Premature death rates from cardiovascular disease range from 40.5 per 100,000 in France to 248 per 100,000 in Latvia, a ratio of 1 to 6. Globally, premature mortality due to cardiovascular disease is 2.5 times higher in men than in women.

The average rates of hospital discharges in the European Union were 2,190,000 for cardiovascular disease; 629,000 for coronary heart disease; and 356,000 for stroke. These data are for the latest year available. (3)

In Africa, Western Asia and Southeast Asia, 15--20 percent of the estimated 20 million annual deaths are due to cardiovascular diseases. This translates to 3 to 4 million deaths, bringing the total for developing countries to 8 or 9 million, or about 70 percent more than that for developed countries.

An annual survey on cardiac interventions in Europe is performed by the working group on Coronary

Circulation of the European Society of Cardiology. Results from 25 countries with an overall population of 525 million showed that in 1993 a total of 756,822 coronary angiograms were reported. This represents a 12 percent increase from 1992. Germany (37 percent), France (21 percent), UK (10 percent), Italy (6 percent) and Spain (5 percent) registered 79 percent of all the coronary angiograms performed.

A total of 183,728 PTCA's were reported in 1993, 24 percent more than 1992. Germany ranked first in per capita procedures, followed by France, Holland, Belgium and Switzerland. In 1993 there were 6,444 stents implanted in patients in 14 reporting countries. This represented a 53 percent mean increase over 1992.

In both developed and developing countries, deaths from cardiovascular disease still account for almost 50% of all deaths. In the third monitoring report of the World Health Organization, 1991--93, it was stated that cardiovascular diseases are the principal cause of mortality in Europe, accounting for more than 50% of all deaths in those older than age 65, and they cause 12 million deaths in the world each year. Many cardiovascular events aren't fatal but may be sufficiently debilitating to seriously affect functional ability. This is hard to assess without reliable morbidity data, but it may well be that 25--30% of the cardiovascular disease burden arises from disabling sequelae of stroke or other forms of heart disease.

## 2. Heart Anatomy

The heart is the center of the cardiovascular system that flows the blood to the body. It is a hollow, muscular organ that weighs 250-350 grams, about 12 cm long and 9 cm wide at its broadest point, and 6 cm thick. It beats over 100,000 times a day to pump 7,000 liters of blood per day through over 40,000 kilometers of blood vessels. The blood vessels form a network of tubes that carry blood from the heart to the tissues of the body and the return it to the heart.

The heart is situated between the lungs and is a component of the mediastinum, the mass of tissue between the lungs that extends from the sternum to the vertebral column. About 2/3 of the heart mass lies to the left of the body's midline. The heart is enclosed and held in place by the pericardium. The wall of the heart is divided into 3 layers: epicardium (external layer), myocardium (middle layer), and endocardium (inner layer). The interior of the heart is divided into 4 cavities called chambers that receive the circulating blood. The 2 superior chambers are called the right and left atria. Each atrium has an appendage called auricle that increases the atrium's surface area. The atria are separated by a partition called the interatrial septum. The 2 inferior chambers are the right and left ventricles

that are separated from each other by an interventricular septum. The muscle tissue of the atria and ventricles is separated by connective tissue that also forms the valves. The coronary sulcus separates the atria from the ventricles that encircles the heart and houses the coronary sinus and circumflex branch of the left coronary artery. The anterior interventricular sulcus and posterior interventricular sulcus separate the right and left ventricles externally. The sulci contain coronary blood vessels and a variable amount of fat.

The right atrium receives blood from all parts of the body except lungs through three veins (superior vena cava, inferior vena cava, and coronary sinus), and then delivers the blood into the right ventricle, which pumps the blood into pulmonary trunk. The pulmonary trunk divides into a right and left pulmonary artery, each of which carries blood to the lungs. In the lungs, the blood releases its carbon dioxide and takes on oxygen. Blood returns to the heart via four pulmonary veins that empty into the left atrium. The blood then passes into the left ventricle, which pumps the blood into the ascending aorta. From here the blood is passed into the coronary arteries, arch of the aorta thoracis aorta and abdominal aorta. These blood vessels and their branches transport the blood to the heart and all other body parts, except the lungs.

The thickness of the four chambers varies according to function. The atria are thin-walled because they need only enough cardiac muscle tissue to deliver the blood into the ventricles with the aid of gravity and a reduced pressure created by the expanding ventricles. The right ventricle has a thicker layer of myocardium than the atria, since it must send blood to the lungs and back around to the left atrium. The left ventricle has the thickest wall, since it must pump blood at high pressure through literally thousands of kilometers of vessels in the head, trunk, and extremities. As each chamber of the heart contracts, it pushes a portion of blood into a ventricle or out of the heart through an artery. In order to keep the blood from flowing backward, the heart has structures composed of dense connective tissue covered by endothelium called valves. Atrioventricular valves lie between the atria and ventricles. The wall of the heart, like any other tissue, has its own blood vessels. The flow of blood through the numerous vessels that pierce the myocardium is called coronary (cardiac) circulation (Heartonline, 2005).

Heart is the flowing center of the blood, and it supplies the whole body of an animal for the requirement of the oxygen and nutrients that are delivered by blood to everywhere of the body. Figure 1 shows the flowing of the blood in a human body (Figure 1).

The flowing of the blood:

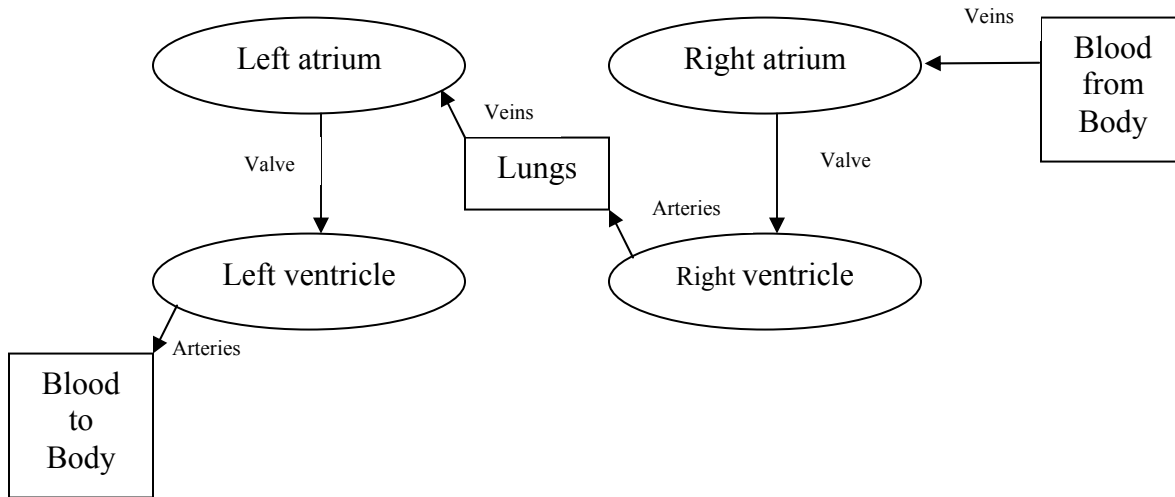


Figure 1. Flowing of the blood

### 3. Anemia

**Definition:** Anemia is a lack of red blood cells and/or hemoglobin. There are over 30 different types of anemia, including sickle cell anemia. Although most forms of anemia can be successfully treated, there are some forms that are chronic, damaging or even life-threatening. Severe cases of anemia have been associated with an enlarged heart, cardiomyopathy and other heart-related conditions. Anyone experiencing symptoms such as chronic fatigue, weakness, paleness and shortness of breath (especially while physically active) is urged to get a check-up with their physician.

**Prevention:** Eating a balanced, heart-healthy diet can help prevent the most common forms of anemia. Other types of anemia are present since birth, or develop for unknown reasons, and have no known prevention strategies.

**Treatment:** A popular misconception is that people who have anemia should simply take iron supplements. Iron supplements should be avoided unless prescribed by a physician, because an excess level of iron could damage the heart or other vital organs. Most forms of anemia can be successfully treated with supplements, injections of specific vitamins and/or increased intake of nutrient-rich foods (Heartonline, 2005).

### 4. Angina

**Definition:** Angina (angina pectoris) is a type of temporary chest pain, pressure or discomfort. It is a symptom of cardiac ischemia — a condition in which

the heart is not getting enough oxygen-rich blood to feed itself and the rest of the body. In one type of angina, called stable angina, the attacks happen only when the heart needs extra oxygen, like when a person climbs a long flight of stairs or jogs across the street. In other types of angina, such as unstable angina, angina attacks may occur even when a person is at rest.

**Prevention:** It is important to have a heart-healthy diet that is low in cholesterol and fats and oils, and make a good control of diabetes and high blood pressure.

**Regular exercise:** Quitting Smoking and staying away from second-hand tobacco smoke.

**Treatment:** Medications used to treat angina either increase the supply of oxygen to the heart muscle, or reduce the heart's need for oxygen. These medications include the following: Beta-blockers; nitrates; calcium channel blockers; antiplatelet; anticoagulant; angioplasty; stenting; atherectomy; coronary artery bypass grafting; minimally invasive bypass surgery; percutaneous coronary intervention; external counterpulsation (Heartonline, 2005).

### 5. Arrhythmia

**Definition:** An arrhythmia is an irregular heartbeat resulting from any change, deviation or malfunction in the heart's conduction system — the system through which normal electrical impulses travel through the heart. An arrhythmia may be unusually fast (tachycardia) or unusually slow (bradycardia). Some

arrhythmias are signs of more serious heart problems, and others are not. An arrhythmia may be brief and unnoticeable, or it may be startling, obvious or even fatal (Table 1, Table 2)

Table 1. Arrhythmia Prevention

Quitting or reducing reducing alcohol and caffeine intake
Quitting smoking
Avoiding certain medications (e.g., decongestants)
Using stress management techniques

Table 2. Arrhythmia Treatment

Beta-blockers
Calcium channel blockers
Digoxin
Surgery to implant an artificial pacemaker
Surgery to implant an implantable cardioverter defibrillator (ICD)
Electrophysiological surgery with catheter ablation.

## 6. Atherosclerosis

Definition: Also known as "hardening of the arteries," atherosclerosis is a disease in which the arteries are hardened and narrowed as a result of plaque, which has built up along the inside of the artery walls. The disease is a chief contributor to cardiovascular disease. Atherosclerosis may begin as early as childhood, but it is the advanced stages of this condition that are the most dangerous later in life. These

advanced stages can cause a narrowing (stenosis) of the artery and speed the rate at which the artery is blocked or closed altogether (occlusion). If the affected artery is one of the coronary arteries (located on the surface of the heart), then a lack of oxygen-rich blood to the heart (cardiac ischemia) could cause coronary artery disease (CAD) and, consequently, increase an individual's risk of the following: Angina, Heart attack, Cardiac arrest, Sudden cardiac death (Table 3, Table 4).

Table 3. Atherosclerosis Prevention

Quitting smoking
Controlling diabetes
Controlling high blood pressure (hypertension)
Reducing the amount of fats and oils and cholesterol
Achieving and maintaining a healthy weight (avoid Obesity)
Keeping a routine of moderate to vigorous exercise
Learn your family medical history
Getting regular physical examinations
Stress management
Controlling chronic depression

Table 4. Atherosclerosis Treatment

Antiplatelets (e.g., aspirin) - inhibit the formation of blood clots.
Beta-blockers - reduce the workload of the heart by blocking the effect of adrenaline on the heart.
Nitrates - work directly on the muscles of the heart and blood vessels, causing them to relax and allowing oxygen-rich blood to reach the heart.
Cholesterol reducing drugs - lowers the patient's level of fats (lipids) in the blood, such as cholesterol and triglycerides.
ACE inhibitors - block the production of a substance that causes blood vessels to tighten, allowing more oxygen-rich blood to flow into the heart.
Vitamins - may also be helpful, especially folic acid, which counteracts the dangerous effects of an amino acid called homocysteine.
Balloon angioplasty - A balloon-tipped catheter presses plaque back against the artery walls, increasing the amount of room through which blood can pass through the vessel.
Stenting - A wire mesh metal tube called a stent can be inserted into the area of a damaged artery.
The stent acts as a scaffold, stretching and supporting the artery walls, and permitting blood to flow freely through the previously blocked vessel.
Atherectomy - uses one of three catheters, all of which destroy plaque by cutting it away.
Depending on the technique used, the residue is pulverized and 1) allowed to flow harmlessly through the bloodstream; 2) removed as the catheter is withdrawn; or 3) vacuumed through the catheter and out of the body during the procedure.

## 7. Diabetes

Definition: Diabetes is a disorder in the body's ability to use blood sugar (glucose). Glucose is the main source of energy for the human body, which is taken from the starches and sugars that people eat and travels through the bloodstream, circulating throughout the body. Normally, the body's tissues can absorb the glucose and use it for energy with the help of hormone insulin that is produced in the pancreas (an organ next to the stomach). Unless the body has enough insulin and the ability to use insulin properly, glucose will simply build up in the bloodstream and then get flushed from the body in the urine, rather than go into the cells to feed them. Therefore, people with untreated diabetes may have dangerously high blood sugar levels. These high blood sugar levels can lead to a variety of symptoms (e.g., weakness) in the short-term, and serious consequences such as heart attack, stroke or other consequences of diabetes in the long-term.

There are two types of diabetes: Type I and Type II. Type I is thought to be caused by a combination of

genetic factors and environmental factors that result in a lack, or complete absence, of insulin. For example, a viral infection can cause the immune system to attack itself. As a result, the body may destroy over 90% of its own insulin-producing (beta) cells in the pancreas. Much more common, Type II diabetes has been linked to obesity (weighing more than 20% of one's ideal weight), inactivity and being over 40 years old. Diabetes can also be caused by pregnancy (a pregnancy complication known as gestational diabetes), drug use or the use of certain steroids.

Patients with Type II diabetes do manufacture insulin, sometimes even more so than necessary, but for some reason their bodies reject and/or do not detect it, resulting in what the body perceives as a deficiency. This insulin blockage is due to cell abnormalities of unknown cause in the liver and muscles. The onset of this type of diabetes, also called adult-onset diabetes, usually occurs after age 30 (Table 5, Table 6).

Table 5. Diabetes Prevention

Maintaining a balanced diet low in fats and oils, low in sweets, and high in fiber.
Eating regular meals and light snacks
Lowering cholesterol levels
Maintaining proper weight to avoid obesity — a major risk factor for Type II diabetes
Engaging in regular exercise, which lowers blood sugar levels and helps the body to use insulin

Table 6. Diabetes Treatment

Insulin injections
Diet treatment e.g., sugar control
Rest
Exercise
Nutrition

**Diabetes Treatment:** Treatment for Type I currently requires insulin injections, although other strategies for taking insulin are currently being researched (e.g., nasal spray or skin patch). Type II requires medication and sometimes insulin injections. Both types require lifestyle changes that include diet. People with Type II diabetes are often treated with medication. Depending on the severity of the condition, they may be able to take oral medications instead of injections. However, some insulin injection may still be used. Insulin is generally injected by the patient (or a child patient's parent) under the fat layer of the arm, leg or stomach.

### 8. Hypertension

Definition: Hypertension is the medical term for high blood pressure. Blood pressure is the measure of the force of the blood pushing against the walls of the arteries — the blood vessels that carry blood from the heart to the rest of the body. When the heart contracts to pump out blood, pressure is highest. This measurement is called the systolic pressure. After pumping, the heart relaxes and pressure drops to its lowest point just before a new beat. This measurement is called the diastolic pressure. The measurement of an individual's blood

pressure is always expressed as systolic pressure over diastolic pressure. For example, normal blood pressure for adults is considered to be in the range of 120/80 millimeters of mercury. Generally, blood pressure above 140/90 is considered to be high for adults, and blood pressure under 90/60 is considered to be low for adults. Hypertension, or high blood pressure, is a condition commonly associated with narrowing of the arteries. This causes blood to be pumped with excessive force against the artery walls. It is a sign that the heart and blood vessels are being overworked. Untreated, hypertension will cause the heart to eventually overwork itself to the point where serious damage can occur. For instance, the heart muscle can thicken (hypertrophy) and function abnormally, or dilate and constrict less forcefully (dilated cardiomyopathy). There may also be injury to the brain, the eyes (retinopathy) and/or the kidneys (nephropathy). Hypertensive patients are also at increased risk of heart disease and stroke. Most cases of high blood pressure have no cure, but the overwhelming majority can be managed and controlled with diet and medication (Table 7, Table 8).

Table 7. Hypertension Prevention

Quitting smoking.
Losing weight.
Controlling diet.
Getting adequate amounts of vitamins and minerals.
Engaging in regular aerobic exercise.
Limiting alcohol
Limiting salt intake to 2,000 milligrams (2 grams) of sodium per day.

Table 8. Hypertension Treatment

Monitor their blood pressure at home, under the guidance of their physician.
Diuretics - Medications that promote the formation of urine in the kidneys, causing the body to flush out excess fluids and minerals, especially sodium.
Alpha-blockers and beta-blockers - Medications that inhibit alpha and beta receptors in various parts of the nervous system, which slows the heart rate. This helps arteries to relax, decreases the force of the heartbeat and reduces blood pressure. Beta blockers are especially useful in patients with heart disease.
ACE inhibitors - These medications are types of vasodilators that help to reduce blood pressure by inhibiting the substances in the blood that cause blood vessels to constrict. Recent studies suggest that this class of drugs may be superior to others in preventing stroke, heart disease and kidney disease in patients (especially diabetics) with risk factors for vascular disease. They are also very useful in patients with established heart disease.
Angiotensin II receptor blockers (ARBs) - This new class of drugs is showing good results and great promise in reducing hypertension-related complications. Although beta blockers, ACE inhibitors and diuretics are currently used most often in the treatment of hypertension, ARBs may be prescribed more often in the future.
Calcium channel blockers - These are types of vasodilators that inhibit the flow of calcium into heart and blood vessel tissues, which reduces tension in the heart, relaxes blood vessels and lowers blood pressure. Unfortunately, most studies have not shown that these agents reduce the risk of death from hypertension, and some of these medications may increase the risk of death from hypertension.
Using stress management techniques.

## 9. Obesity

**Definition:** Obesity is a condition in which people are more than 20 percent over their ideal weight. Currently, more than one-third of Americans are obese (Table 9, Table 10).

Table 9. Obesity Prevention

Reducing fat intake - In the last few years, research has suggested that cutting one's fat intake is a more effective weight loss strategy than counting calories. A number of nationally recognized weight loss programs ask people to keep track of the types of foods they eat (such as fats, meats or dairy) rather than the number of calories included in those different types of food.
Choosing a more active lifestyle - Moderate and sustained physical activity is essential to achieving and maintaining a healthy weight. Aerobic exercise, such as walking, swimming or stair climbing, can help to keep weight off while at the same time providing many other benefits to an individual's overall health and well being.
Avoiding smoking and alcohol use - These strategies for relieving <a href="#">stress</a> do not solve whatever problem is at hand, and often make situations worse (e.g., by causing new health problems). By using healthy "stress-burning" techniques instead of excessive alcohol use or smoking, individuals can reach weight loss goals more quickly.
Counseling on diet - Some people have trouble controlling their food intake not because of hunger, but because of emotional needs. People who use food to try to fill a feeling of emptiness, to comfort themselves or to gain a sense of control may benefit from speaking to a qualified counselor about the situation. Inpatient programs are available around the country, in which people stay overnight as they relearn to eat only when hungry and to satisfy emotional needs through other means.

Table 10. Obesity Treatment

Drugs used to treat obesity usually affect levels of certain hormones (e.g., serotonin and noradrenaline) in areas of the brain associated with food intake and satisfaction. This temporarily decreases the urge to eat and, with appropriate diet and exercise, supports weight loss efforts. There are some drawbacks, however. These drugs can produce serious side effects, such as high blood pressure in the blood vessels of the lungs (pulmonary hypertension) and valvular heart disease. These medications should only be used by patients whose treatments are closely monitored by a qualified physician.
Cutting calories
Starting an exercise program
Using healthy stress management techniques
Surgical intervention - In rare cases, surgery may be the treatment of choice for people with clinically severe obesity who have not been helped by other medical therapies. One common surgical technique is gastric stapling (the “tummy tuck”), which uses bands or staples to decrease the amount of space in the stomach available for food. Another type of surgery is the gastric bypass, in which part of the small intestine is bypassed as food passes out of the stomach. The gastric bypass involves significant changes in how food and drink can be taken in, and people are encouraged to learn all about the surgery before having it done. For all surgical candidates, an integrated medical program must be in place to provide guidance on diet, physical activity and support before and after the surgery.

### 10. Plaque Rupture

**Definition:** LDL (“bad”) cholesterol produces poisons (toxins) that damage the lining (endothelial cells) of the inside wall of an artery. This damage contributes to the formation of tiny wounds or lesions on that inside wall. Other fatty materials in the bloodstream (e.g., triglycerides) are attracted to those lesions and begin to build up there. White blood cells rush to the site of the irritation to devour harmful substances, but only cause the lining of the artery to become sticky, attracting even more LDL molecules. Clot-producing platelets begin to collect over the site, releasing still more irritating substances and trapping more fatty particles and white blood cells. This gradual

build-up of fatty materials and toxins is known as plaque. As the plaque continues to build up, some of the plaque formations develop a relatively thick covering (due to calcification). These types of plaque are considered to be stable plaques and are a primary cause of hardened and narrowed arteries (atherosclerosis). Other types of plaque are known as unstable plaques, which (in comparison to stable plaques) have the following: A larger fatty core; More white blood cells encased within; A thinner, softer, more unpredictable coating that might be stripped off at any time without warning. If the coating of an unstable plaque is stripped off, this is known as a plaque rupture (Table 11, Table 12).

Table 11. Plaque Rupture Prevention

Reducing the amount of fats and oils and cholesterol in diet
A routine regimen of moderate to vigorous exercise
Quitting smoking
Controlling diabetes.
Controlling high blood pressure.
Getting regular physical examinations.



Table 12. Plaque Rupture Treatment

Antiplatelets (e.g., aspirin or clopidogrel) - inhibit the formation of blood clots by decreasing the ability of platelets (the body's natural blood-clotters) to bind together. In the case of atherosclerosis, antiplatelets prevent a damaged vessel from becoming blocked due to excessive concentration of platelets.
Anticoagulants - also help to minimize the formation of blood clots.
Lifestyle changes
Cardiac catheterization - During this procedure, a thin tube (catheter) is inserted through a blood vessel in the body (usually the groin) and fed all the way to the heart. Once in place, the physician may choose to do a balloon angioplasty, which uses a balloon-tipped catheter to press plaque back against the artery walls, increasing the amount of room through which blood can pass through the vessel. A variant of the balloon angioplasty is the laser angioplasty.

## 11. Stroke

**Definition:** Also known as a cerebrovascular accident (CVA), a stroke is a life-threatening event in which part of the brain is not getting enough oxygen. A stroke can cause oxygen-starved brain cells to die within minutes. Rapid response to stroke can result in little apparent damage, but a stroke left untreated for too long can result in neurological and tissue damage (e.g., permanent loss of speech or paralysis) or death. There are two different types of strokes: Ischemic and Hemorrhagic (Table 13, Table 14).

Table 13. Stroke Prevention

Controlling hypertension (high blood pressure) - Blood pressure abnormalities must be continually monitored and controlled because they are a chief contributor to strokes.
Getting treatment for atrial fibrillation or atrial flutter.
Getting treatment for sleep apnea.
Learning stress management techniques and seeking help for depression or drug abuse.
Reducing cholesterol levels, perhaps by taking cholesterol-reducing drugs.
Increasing one's level of exercise.
Maintaining an ideal weight.
Refraining from or quitting smoking.
Limit use of alcohol to about one glass of wine or one beer per day, which may help in the prevention of strokes.
Controlling diabetes.
Eating a heart-healthy diet.

Table 14. Stroke Treatment

Drugs
Rest
Nutrition
Exercise

People having symptoms of a stroke should call 911 immediately. Maintaining breathing in patients who may be losing consciousness. This is done through the use of breathing equipment and/or supplemental oxygen. People may be advised by their physician to take aspirin or other antiplatelet agents to help prevent the formation of blood clots.

For people who have obstructed or partially obstructed carotid arteries, and have already had a stroke or TIA related to that condition, a surgery known as a carotid endarterectomy may be an option to prevent

another life-threatening event. This surgery may also be performed if the person has not had a stroke or TIA but has greater than 80 percent blockage in the carotid arteries. A carotid endarterectomy involves the removal of fatty build-up from the carotid arteries supplying blood to the brain. While the person is under general anesthesia, the plaque from the artery is removed along with the entire inner lining of the artery. Carotid stent placement within the carotid arteries is a less invasive catheter-based procedure currently being studied as an alternative to surgery.

A carotid aneurysm that has not yet ruptured may be diagnosed early, particularly if it was causing warning signs that led the patient to seek treatment. Surgery may be necessary to repair the aneurysm, preventing a hemorrhagic stroke.

Performing a computed tomography (CT) scan to determine whether someone is suffering from an ischemic stroke or a hemorrhagic stroke. If it is an ischemic stroke, then thrombolytic medications may be given intravenously to dissolve the obstructing blood clots. However, giving thrombolytic medications to a patient having a hemorrhagic stroke would worsen the existing bleeding in the brain and should be avoided. Special attention may be given to maintaining nutritional needs intravenously or through the mouth and preventing pneumonia, a common complication after a stroke.

People who survive a stroke will often need to undergo treatment (i.e., stroke rehabilitation) to deal with some of the long-term effects of the event. The goal of the treatment is to minimize as much neurological damage as possible, such as impaired movement or speech. The sooner that treatment is begun, the more likely it is that patients will regain significant functions. Individuals may also experience depression, which may be related to the temporary or permanent loss of basic functions. If this should occur, patients are urged to seek the help of a qualified counselor for support and treatment.

#### **Glossaries and special notes:**

**Plasma fibronectin.** A protein that is believed to protect brain cells from damage from an ischemic stroke. A recent study published in *Nature Medicine* (2001) found that mice lacking the ability to produce this protein suffered 40 to 50 percent more damage from strokes than mice with normal levels of this protein.

**ORP150 (oxygen-regulated protein 150 kD).** A chemical that is created in the body as a result of oxygen starvation. Another study published in *Nature Medicine* (2001) reported that brain cells treated with ORP150 were only 40 to 50 percent as likely to die from oxygen starvation as untreated cells.

**Stem cell transplants.** Stem cells are basic cells that have the ability to develop into many different types of cells. They start out very similar to each other, but depending on where they develop, the cells become highly specialized to their individual functions. Researchers are investigating a variety of methods in which stem cell transplants could be used as a treatment for stroke damage and other conditions involving damaged brain cells.

**Hypothermia.** Researchers at the Cleveland Clinic Foundation in Ohio are currently studying whether

lowering a patient's body temperature can decrease the amount of damage that occurs during a severe stroke.

**Endovascular Photo Acoustic Recanalization (EPAR).** A laser that is fed through a catheter into the brain to destroy blood clots that could potentially cause a stroke. Clot busting drugs are currently the only method available to break up an existing blood clot in the brain. However, they can take up to an hour to be effective. EPAR can take less than a minute, restoring blood flow and oxygen to the brain and drastically reducing the amount of stroke damage.

**PPI.** A drug that blocks the production of a protein called Src. After a stroke, Src causes blood vessels to leak, which lead to brain swelling and damage. A study published in *Nature Medicine* (February 2001) found that when PPI was given to mice within 15 minutes of an arterial blockage, the resulting stroke produced 70 percent less damage.

**Cholesterol-lowering drugs.** A study published in *Circulation* (January 2000) indicated that one type of statin may decrease a patient's risk of stroke and diabetes. It is not known whether this effect is common to all cholesterol-reducing drugs or just the specific drug studied in the trial (pravastatin).

**Atherosclerosis.** A disease in which the arteries are hardened and narrowed, due to the gradual build-up of plaque on their inner walls.

**Hypertension, or high blood pressure,** is a condition commonly associated with narrowing of the arteries. This causes blood to be pumped with excessive force against the artery walls. It is a sign that the heart and blood vessels are being overworked. Untreated, hypertension will cause the heart to eventually overwork itself to the point where serious damage can occur. For instance, the heart muscle can thicken (hypertrophy) and function abnormally, or dilate and constrict less forcefully (dilated cardiomyopathy). There may also be injury to the brain, the eyes (retinopathy) and/or the kidneys (nephropathy). Hypertensive patients are also at increased risk of heart disease and stroke. Most cases of high blood pressure have no cure, but the overwhelming majority can be managed and controlled with diet and medication.

Hypertension is a major health problem in the United States, where more than 50 million people (1 in 4 adults) have the condition, according to the American Heart Association. It is especially common among African-Americans, who are one of the most likely ethnic groups in the world to be diagnosed with high blood pressure. It has also been diagnosed in two-thirds of Americans over 65 and a growing number of children.

According to the American Heart Association's *2001 Heart and Stroke Statistical Update*, more than 30 percent of Americans with high blood pressure are unaware that they have this potentially life threatening

condition; another 26 percent are on medication, but do not have their blood pressure under control.

Diabetes is a disorder in the body's ability to use blood sugar (*glucose*). Glucose is the main source of energy for the human body. It is taken from the starches and sugars that people eat. It travels through the bloodstream, circulating throughout the body.

Normally, the body's tissues can absorb the glucose and use it for energy with the help of *insulin*. Insulin is a hormone produced in the pancreas (an organ next to the stomach) that is normally secreted when glucose levels are high. Unless the body has enough insulin and the ability to use insulin properly, glucose will simply build up in the bloodstream and then get flushed from the body in the urine, rather than go into the cells to feed them. Therefore, people with untreated diabetes may have dangerously high blood sugar levels. These high blood sugar levels can lead to a variety of symptoms (e.g., weakness) in the short-term, and serious consequences such as heart attack, stroke or other consequences of diabetes in the long-term.

Diabetes affects about 10 to 20 million Americans, which is about 6 percent of the United States population. Because diabetes often runs in families, those with one or more diabetic relatives are advised to be especially vigilant in maintaining a low-fat, low-to-moderate sugar diet and exercising regularly. African-American, Hispanic, Asian and Native American individuals are at a higher risk of developing the condition. A quick, simple blood test or urinalysis can check for diabetes.

There are two types of diabetes: Type I and Type II. Type I is thought to be caused by a combination of genetic factors and environmental factors that result in a lack, or complete absence, of insulin. For example, a viral infection can cause the immune system to attack itself. As a result, the body may destroy over 90 percent of its own insulin-producing (*beta*) cells in the pancreas. Much more common, Type II diabetes has been linked to obesity (weighing more than 20 percent of one's ideal weight), inactivity and being over 40 years old. Diabetes can also be caused by pregnancy (a pregnancy complication known as *gestational diabetes*), drug use or the use of certain steroids.

Before the discovery of insulin in 1921, the long-term prognosis for diabetics was not good. Today, most diabetes can be managed and controlled with a combination of insulin treatment (either medications or injections) and lifestyle modifications. Other strategies for taking insulin, such as nasal sprays and skin patches, are currently being researched.

Obesity is a condition in which a person is more than 20 percent over his or her ideal weight. It is the second leading cause of preventable death, contributing to serious health problems such as cancer, heart disease and stroke. There are a number of treatments available for obesity, including cutting calories, starting an exercise program, using healthy stress management techniques and getting supportive counseling. Medications are also available, if necessary. In severe cases, surgery (e.g., gastric stapling or gastric bypass) may be necessary.

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