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BACKGROUND

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## The Heart, Coronary Artery Disease, and Bypass Surgery

### The Heart

The heart is a muscular organ that continuously pumps blood rich with nutrients and oxygen from the heart and lungs to the cells of the body. In order to accomplish this task, the cells of the heart must also receive oxygen and nutrients. This is accomplished in the delivery of the oxygenated and nutrient-rich blood to the heart via the coronary arteries.

### Coronary Artery Disease (CAD)

There are several coronary arteries that deliver oxygen and nutrients to the heart's own tissue. These coronary arteries can become blocked by a buildup of cholesterol fats, often referred to as plaque. Plaque deposits can make the arteries stiff and irregular, making blood flow less efficient. This is called hardening of the arteries. There may also be a single blockage or multiple blockages, and they can vary in severity and location.

Any narrowing, or blockage, of the coronary arteries reduces the blood supply to the heart tissue, therefore reducing the amount of oxygen and nutrients delivered. This inhibits the normal function of the heart muscle.

#### *Symptoms of CAD*

A person with one or more blocked arteries may feel pain and periodic discomfort in the chest, radiating to the neck and/or arms (usually on the left side). Symptoms can be triggered by physical exertion, eating, changes in temperature, extreme emotion or may be present even at rest. The symptoms may last 3 to 5 minutes until the cause is relieved; otherwise symptoms may last longer. If this continues, it can starve the heart muscle cells of oxygen and eventually lead to a heart attack.

#### *Risk Factors*

Several factors are known to contribute to the buildup of plaque in the coronary arteries. It is often the combination of several of these risk factors, rather than a single factor that contributes to the development of CAD. Some of the risk factors such as gender, age, and heredity can only be noted – they cannot be changed. Other factors, however, can be controlled, including:

High blood pressure	Body weight
Smoking	Diabetes
High cholesterol levels	Stress
Lack of proper exercise	Poor diet <sup>1</sup>

### *Prevalence of CAD*

Coronary artery disease is a huge health problem in the United States. According to the most recent figures from the American Heart Association, coronary artery disease is the single leading cause of death in America today.<sup>2</sup>

More than 12 million people alive today have a history of heart attack, angina pectoris (chest pain) or both. An estimated 1,100,000 Americans will have a new or recurrent coronary attack this year – one-third of these patients will die.<sup>1</sup>

Men over the age of 65 are the largest segment of CAD patients. Historically, coronary artery disease has been considered a man's disease, but it is also the leading cause of death among women in the U.S. According to the National Institutes of Health, African-American women in particular are 24 percent more likely to die of coronary artery disease than their Caucasian-American counterparts.<sup>1</sup>

Older women also have significantly higher rates of coronary artery disease than younger women. On average, women develop coronary artery disease 15 years later than men and 39 percent of women die from the disease as compared to 31 percent of men.<sup>1</sup>

### *Non-Surgical Treatment Options*

Each year, many patients with CAD will need treatment to restore the flow of blood to the heart. That treatment might include drug therapy, angioplasty or surgical intervention.

Drugs can work to dilate the coronary arteries, enabling more blood to be delivered to the heart tissue. Angioplasty is a procedure where a tiny balloon is inserted into the blocked artery and inflated at the site of a blockage. Inflating the balloon reopens the vessel by pushing the plaque back against the wall of the artery. The balloon is then deflated and removed. A small scaffold called a stent can also be placed in the artery after angioplasty to ensure that the artery remains open.

Drug therapy only treats the symptoms of CAD. In addition, drugs often have adverse side effects and are not always effective at increasing the blood supply to the heart. Angioplasty may not be suited for treatment of all types of blockages and the duration of its effect can vary. In some cases, angioplasty may fail and arteries can become blocked again.

### **Bypass Surgery**

Coronary Artery Bypass Grafting (CABG) (commonly called “bypass surgery”) is a safe and effective way of surgically treating the symptoms of CAD. It is a procedure that reroutes the blood around a blockage in the coronary artery by creating an alternative pathway for blood to deliver important nutrients and oxygen to the heart muscle.

Grafts are created by using portions of another artery or vein from the patient's body. The most commonly used vessels are the internal mammary arteries, which are inside the chest wall, or the greater saphenous veins, which are in the leg. Grafts remain open for variable periods of time, but it is common for them to last 10-12 years – often longer.

### *Conventional Bypass Surgery*

Conventional bypass surgery is performed on a stopped heart through a 10-12" incision down the middle of the chest. Patients are placed on cardiopulmonary bypass (CPB) (often called a heart-lung machine). The heart-lung machine functions as the patient's heart and lungs during the operation. About 700,000 conventional coronary artery bypass procedures are performed annually, worldwide.

### *Beating Heart Bypass Surgery*

Beating Heart bypass surgery avoids the use of the heart-lung machine by enabling the procedure to be performed on a beating heart, rather than on a stopped or "arrested" heart. If the surgeon chooses to operate on a beating heart, an incision is made in the chest, and a stabilization system is used to steady only the portion of the heart where the surgeon is operating. The use of suction or compression stabilizes that portion of the heart while the graft is sewn into place.

Medtronic, Inc., headquartered in Minneapolis, is the world's leading medical technology company, providing lifelong solutions for people with chronic disease. Its Internet address is [www.medtronic.com](http://www.medtronic.com).

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### **References**

- <sup>1</sup>"Facts About Coronary Heart Disease." *National Institutes of Health*. <http://www.nhlbi.nih.gov>, (27 July 2001).
- <sup>2</sup>"Coronary Heart Disease." *American Heart Association*. <http://www.americanheart.org> (27 July 2001).