Dr. B. K. Goyal receiving the Padma Vibhushan Award from His Excellency Dr. A. P. J. Abdul Kalam, President of India.

Dedicated to
my esteemed parents

Smt. Sarju Devi
and
Rai Bahadur Seth Shrinarain Kayal

FITH EDITION

Preface

The incidence of coronary heart disease is increasing with a galloping speed and unless active preventive and curative measures are taken it will soon assume epidemic proportions.

In the last two decades, there have been revolutionary advances in the management of coronary heart disease. It is of paramount importance to be familiar with the symptoms, preventive measures and methodology of management of this devastating disease. With this view in mind I am presenting to you the facts in a nutshell. I do hope that booklet will be of definite value to the readers as they will have insight in this very important area of public health.

I must record my sincere appreciation of assistance rendered by my colleagues at Bombay Hospital, Dr. Ramesh Kawar, Dr. B.C. Kalmath and Dr. Anil Sharma during the preparation of this manuscript.

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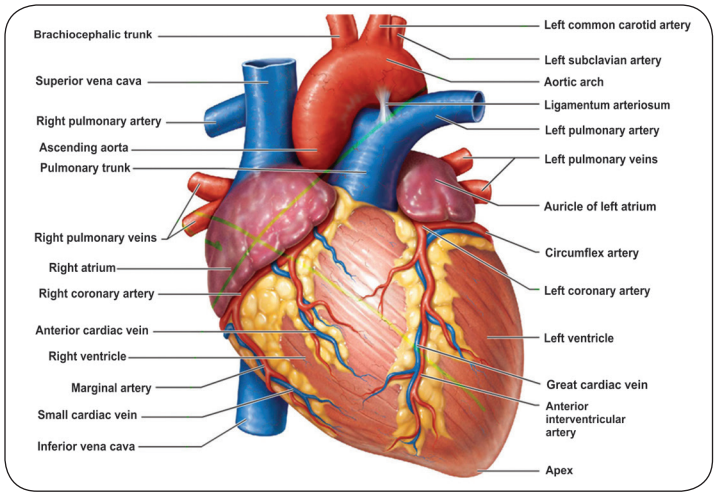


The heart is a muscular organ about the size of a clenched fist that lies in the chest beneath the sternum or breast bone. The function of the heart is to supply blood to all parts of the body. The heart is divided into four chambers, two upper chambers called the right and left atria and two lower chambers called the right and left ventricles.

The left ventricle of the heart pumps blood through the aortic valve into the aorta, the largest artery in the body, and then out through a network of arteries to the whole body. Like all tissues in the body, the heart requires oxygen filled blood in order to function. Blood goes to nourish the heart through the tubes called **coronary arteries.**

Anatomy and Function of the Coronary Arteries:

Like all other tissues in the body, the heart muscle needs oxygen-rich blood to function, and oxygen-depleted blood must be carried away. The two main coronary arteries that supply blood to the heart are the left and right coronary arteries. The left coronary artery ( ) further divides into the left anterior descending artery and the circumflex branch. Usually the doctors therefore refer to three main coronary arteries, the right coronary artery (RCA), and two main branches of the coronary artery.

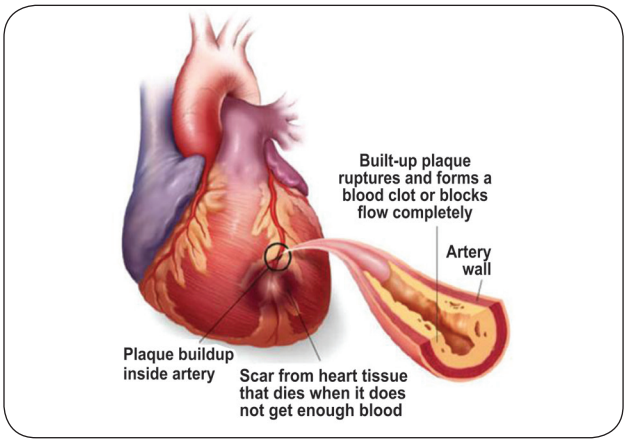
These arteries divide and subdivide until smaller branches deliver blood to all parts of the muscular wall of the heart.

Why are the coronary arteries important?

Since coronary arteries deliver blood to the heart muscle, any coronary artery disorder or disease can have serious implications by reducing the flow of oxygen and nutrients to the heart, which may lead to a heart attack and possibly death. **Atherosclerosis** or hardening of arteries (a build-up of plaque in the inner lining of an artery causing it to narrow or become blocked) is the most common form of coronary artery disease.

Angina And Heart Attack

What is angina?



Angina is a recurring pain or discomfort in the chest that happens when some part of the heart does not receive enough blood. It is a common symptom of coronary heart disease (CHD), which occurs when coronary arteries that carry blood to the heart become narrowed and blocked due to atherosclerosis.

Angina feels like a pressing or squeezing pain, usually in the chest under the breast bone, but sometimes in the shoulders, arms, neck, jaws, back or upper abdomen. Angina is usually precipitated by exertion. It is usually relieved within a few minutes by resting or by taking prescribed angina medicine.

What brings on angina?

Episodes of angina occur when the heart's need for oxygen increases beyond the oxygen available from the blood nourishing the heart. Physical exertion is the most common trigger for angina. Other triggers can be emotional stress, extreme cold or heat, heavy meals, alcohol, and cigarette smoking.

What is the difference between "stable" and "unstable" angina?

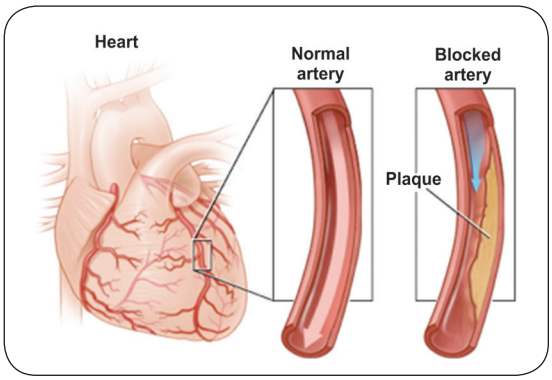
It is important to distinguish between the typical stable pattern of angina and unstable angina.

Angina often recurs in a regular or characteristic pattern. Commonly a person recognizes that he or she is having angina only after several episodes have occurred, and a pattern has evolved. The level of activity or stress that provokes the angina is somewhat predictable, and the pattern changes only slowly. This is **Stable Angina**, the most common variety.

In some patients the degree of narrowing of the arteries is so severe that blood supply is inadequate even at rest. Such patients develop chest pain even at rest or at minimal exertion. This is referred to as an **Unstable Angina.** This is usually an emergency and needs to be aggressively treated. Unless treated it can lead to **Heart Attack** or **Myocardial Infarctions**.

What is a heart attack?

Heart attacks (also called coronary attacks) result from coronary heart disease – disease of the blood vessels that feed the heart muscle. Coronary artery disease and ischemic heart disease are other names for coronary heart disease.



What causes a heart attack?

A heart attack occurs when the blood supply to part of the heart muscle itself is severely reduced or stopped. The medical term for heart attack is **Myocardial Infarction**. The reduction or stoppage happens when one or more of the coronary arteries supplying blood to the heart muscle is blocked. This is usually caused by the buildup of plaque (deposits of fat-like substances) due to atherosclerosis. The plaque can eventually burst, tear or rupture, creating a "snag" where a blood clot forms and blocks the artery. This leads to a heart attack.

If the blood supply is cut off for more than a few minutes, muscle cells suffer permanent injury and die. This can kill or disable someone, depending on how much heart muscle is damaged. Sometimes a coronary artery temporarily contracts or goes into spasm. When this happens the artery narrows and blood flow to part of the heart muscle decrease or stops. We are not sure what causes a spasm. But a spasm can occur in normal-appearing blood vessels as well as vessels partly blocked by atherosclerosis. A severe spasm can cause a heart attack.

Does angina mean a heart attack is about to happen?

An episode of angina is not a heart attack. Angina means that there is underlying coronary heart disease. Patients with angina are at an increased risk of heart attack compared with those who have no symptoms of cardiovascular disease, but the episode of angina is not a signal that a heart attack is about more frequent, last longer, or occur without exercise—the risk of heart attack in subsequent days or weeks is much higher.

Is all chest pain "angina?"

No, not at all. Not all chest pain is from the heart, and not all pain from the heart is angina. For example, if the pain lasts for less that 30 seconds or if it goes away during a deep breath, after drinking a glass of water, or by changing position, it almost certainly is NOT angina and should not cause concern. But prolonged pain, unrelieved by rest and accompanied by other symptoms may signal a heart attack.

How is angina diagnosed?

Usually the doctor can diagnose angina by noting the symptoms and how they arise. However one or more diagnostic tests may be needed to exclude angina or to establish the severity of the underlying coronary disease. These include the electrocardiogram (ECG) at rest, the stress test, and X-rays of the coronary arteries **(coronary "arteriogram or "angiogram")**.

The ECG records electrical impulses of the heart. These may indicate that the heart muscle is not getting as much oxygen as it needs ("**ischemia**"); they may also indicate abnormalities in heart rhythm or some of the other possible abnormal features of the heart.

For many patients with angina, the ECG at rest is normal. This is not surprising because the symptoms of angina occur during stress. Therefore, the functioning of the heart may be tested under stress, typically exercise. In the simplest stress test, the ECG is taken before, during, and after exercise to look for stress related abnormalities. Blood pressure is also measured during the stress test and symptoms are noted.

The most accurate way to assess the presence and severity of coronary disease is a coronary angiogram, an x-ray of the coronary artery. This procedure is covered in detail in chapter 5.

Can a person with angina exercise?

Yes, in stable angina. It is important to work with the doctor to develop an exercise plan. Exercise may increase the level of pain-free activity, relieve stress, improve the heart's blood supply, and help control weight. A person with angina should start an exercise program only with the doctor's advice. Many doctors tell angina patients to gradually build up their fitness level—for example, start with a 5 minute walk and increase over weeks or months to 30 minutes or 1 hour. The idea is to gradually increase stamina by working at a steady pace, but avoiding sudden bursts of effort.

What are the symptoms of heart disease?

The main symptom of coronary heart disease is angina, caused by insufficient oxygen reaching your heart muscle because of the lessened blood flow. Angina is a feeling of heaviness, tightness or pain in the middle of your chest that may extend to your shoulders, arms neck, jaws, back or upper abdomen.

It is most often experienced during exertion – for example if you run for a bus, play a game such as tennis or football, climb stairs or walk uphill. It may come on in cold weather, after a heavy meal or when you are feeling stressed. It disappears once you stop what you are doing or take medication.

Not everyone with coronary heart disease experiences angina. Sometimes the heart is short of blood (ischaemic) but there is no warning chest pain or tightness. This is known as silent ischemia. This is more common among diabetics.

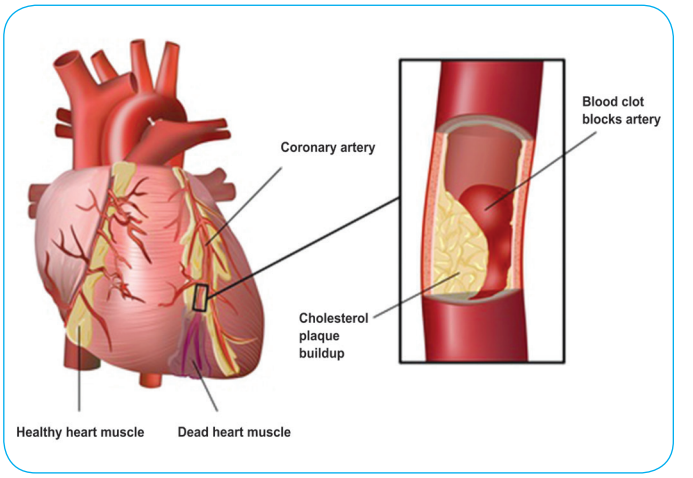
Unfortunately, for many people the first indication that something is wrong is a heart attack, or myocardial infarction. This happens when the blood supply to a part of the heart muscle is interrupted or stops, usually of a blood clot or thrombosis. The pain of a heart attack is severe and unlike angina it does not go away.

Symptom Checklist

The following symptoms are by no means always due to coronary heart disease and could be harmless or due to other medical conditions. However, if you experience any of them it is a good idea to make an appointment to see your doctor:

- Angina – chest pain, heaviness or tightness in the chest that comes on during exertion, emotional stress and may spread to shoulders, arms neck, jaws, back or stomach.
- Unusual breathlessness when doing light activity or at rest, or breathlessness that comes on suddenly.
- Palpitations – awareness of your heart beat or a feeling of having a rapid and unusually forceful heart beat, especially if they last for several hours or recur over several days and/or cause chest pain, breathlessness or dizziness.
- Fainting – although not always a serious symptom, fainting is due to insufficient oxygen reaching the brain which may be due to many reasons, so you should report it to your doctor.
- Discomfort in upper abdomen, belching and sour eructations may at times be mistaken for hyperacidity.
- Fluid retention or puffiness – (oedema to use the medical term) is abnormal accumulation of fluid in tissues such as ankles, legs, lungs and abdomen. Although usually perfectly normal e.g. on a hot day, it can be a sign that the heart is not pumping as well as it should (heart failure).
- Bluish tinged fingernails or around lips – known medically as cyanosis – it can be a result of too little-oxygen in the blood.
- Fatigue – Fatigue is a very common symptom with numerous causes including depression. It is always worth seeing the doctor if you feel unusually fatigued, especially if it is combined with other suspicious symptoms.
- Severe crushing chest pain that may come on at rest and is accompanied by sweating, light-headedness, nausea or shortness of breath and lasts more than 30 minutes may be a heart attack.

Cholesterol and the Heart



One of the major risk factors for heart disease is high blood cholesterol. Cholesterol, a fat-like substance carried in your blood, is found in all of your body's cells. Your liver produces all of the cholesterol your body needs to form cell membranes and to make certain hormones. Extra cholesterol enters your body when you eat foods that come from animals (meat, eggs, and dairy products). Although we often blame the cholesterol found in foods that we eat for raising blood cholesterol, the main culprit is the saturated fat in food. (Be sure to read nutrition labels carefully, because even though a food does not contain cholesterol it may still have large amounts of saturated fat.) Foods rich in saturated fat include butter fat in milk products, fat from red meat, and tropical oils such as coconut oil.

Over a period of years, extra cholesterol and fat in the blood are deposited in the inner walls of the arteries that supply blood to the heart. These deposits make the arteries narrower and narrower. As a result, less blood gets to the heart and the risk of coronary heart disease increases.

Cholesterol travels in the blood in packages called **lipoproteins**. Cholesterol packaged in **low density lipoprotein (LDL)** is often called "bad" cholesterol, because too much LDL in the blood can lead to cholesterol buildup and blockage in the arteries.

Too much low-density lipoprotein (LDL or "bad cholesterol") in the blood causes plaque to form on artery walls, which starts a disease process called atherosclerosis. When plaque builds up in the coronary arteries that supply blood to the heart, you are at greater risk of having a heart attack.

Another type of cholesterol, which is packaged in **high density lipoprotein (HDL)**, is known as "good" cholesterol. That is because HDL helps remove cholesterol from the blood, preventing it from piling up in the arteries.

Blood Cholesterol Levels:

Blood cholesterol levels are measured by means of a small blood sample after 12 hours fasting. The blood should be tested for total cholesterol and, if an accurate measurement is

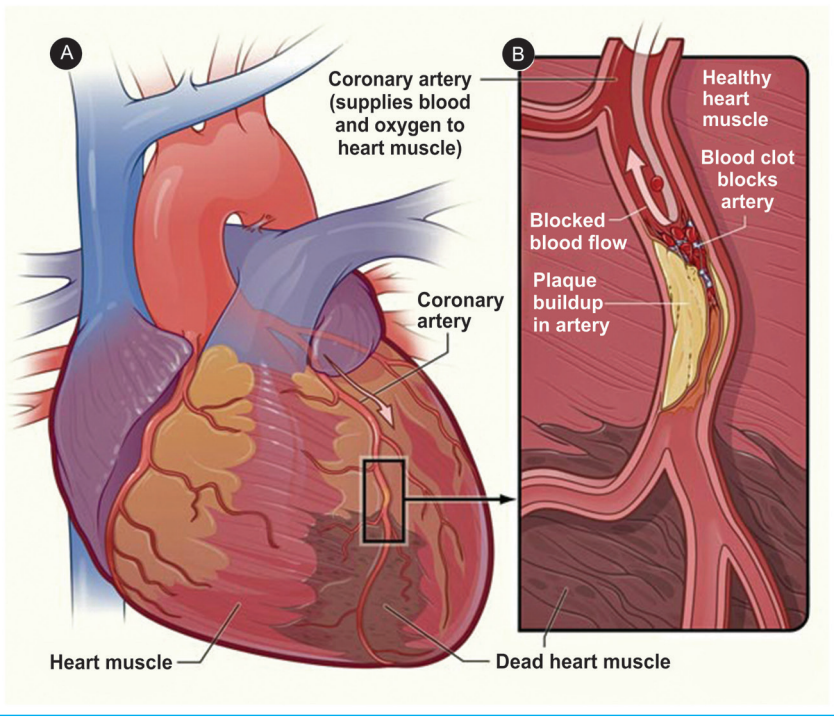
available, for HDL cholesterol as well.

A desirable total cholesterol level for adults without heart disease is less than 200 mg/dL (or 200 milligrams per decilitre of blood). A level of 240 mg/dL or above is considered "high" blood cholesterol. But even levels in the "borderline-high" category (200-239 mg/dL) increase the risk of heart disease.

HDL levels are interpreted differently than total cholesterol levels. The lower your HDL level, the higher your heart disease risk. An HDL level of under 40 mg/dL is a major risk factor for heart disease. A level of 60 mg/dL or higher is considered protective.

An LDL level below 130 mg/dL is desirable. LDL levels of 130-159 mg/dL are borderline-high. Levels of 160 mg/dL or above are high. As with total cholesterol, the higher your LDL number, the higher the risk. In CHD patients and diabetics, desirable level of LDL is below 100mg/dL.

If your tests show that your blood cholesterol levels are in the desirable range, keep up the good work! To help keep your levels healthy, it will be important to eat a low saturated fat, low cholesterol diet, engage in regular physical activity, and control your weight.



Risk Factors for Heart Diseases

Who is at risk of coronary heart disease?

Scientists have still to unravel all the causes of heart disease. However, certain factors can increase your likelihood of developing it. These are known as **risk factors**.

Risk factors are divided into two categories : major and contributing. **Major risk factors** are those that have been proven to increase your risk of heart disease. **Contributing risk** factors are those that doctors think can lead to an increased risk of heart disease, but their exact role has not been defined.

Some risk factors can be changed, treated, or modified, and some cannot. If you have more than one risk factor, your chance of developing heart disease increases. And if you have many risk factors, your chances of developing heart disease increase even more. Controlling as many risk factors as you can through lifestyle changes and, if needed, medicines may help reduce your risk of heart disease.

Major Risk Factors

Hypertension (High Blood Pressure) : High blood pressure increases your risk of heart disease, heart attack, and stroke. Though other risk factors can lead to high blood pressure, you can have it without having other risk factors. If you are obese, you smoke, or you have high blood cholesterol levels along with high blood pressure, your risk of heart disease or stroke greatly increases.

Blood pressure can vary with activity and with age, but a healthy adult who is resting generally has a systolic pressure reading between 120 and 130 and a diastolic pressure reading between 80 and 90 (or below).

High Blood Cholesterol : This topic is covered in detail in chapter 3.

Diabetes : If you have diabetes you are three times more likely to develop coronary heart disease. You are also more likely to have silent ischemia because diabetes can affect the nerves which send pain messages. If you know that you have diabetes, you should already be under a doctor's care, because good control of blood sugar levels can reduce your risk.

Obesity and Overweight : Extra weight is thought to lead to increased total cholesterol levels, high blood pressure, and an increased risk of coronary artery disease. Obesity increases your chances of developing other risk factors for heart disease, especially high blood pressure, high blood cholesterol, and diabetes.

Many doctors now measure obesity in terms of body mass index (BMI), which is a formula of kilograms divided by height in meters squared (BMI = Wt [kg]/Ht2 [m]. According to the National Heart, Lung and Blood Institute, being overweight is defined as having a BMI over 25. Those with a number over 30 are considered obese. Ideal waist size for male is less than 90 cms and for female is less than 80 cms.

Ideal Weight Chart

Height	Weight	
	Men (kg)	Women (kg)
1.52 M (5'.0")	--	50-54
1.54 M (5'.1")	--	51-55
1.56 M (5'.2")	56-60	53-56
1.59 M (5'.3")	57-61	54-58
1.62 M (5'.4")	59-63	56-60
1.65 M (5'.5")	61-65	58-61
1.67 M (5'.6")	62-67	59-64
1.70 M (5'.7")	64-68	61-65
1.72 M (5'.8")	66-71	62-67
1.75 M (5'.9")	68-73	64-69
1.77 M (5'.10)	69-74	66-70
1.80 M (5'.11")	71-76	67-72
1.82 M (6'.0")	73-78	69-74
1.85 M (6'.1")	75-81	--
1.87 M (6'.2")	77-84	--

Smoking : Better known for increasing your risk of lung cancer, cigarette and tobacco smoking also increase the risk of heart disease and peripheral vascular disease (disease in the vessels that supply blood to the arms and legs).

Although nicotine is the main active agent in cigarette smoke, other chemicals and compounds like tar and carbon monoxide are also harmful to your heart. Research has shown that smoking increases heart rate, tightens major arteries, and can create irregularities in the timing of heartbeats, all of which make your heart work harder. Smoking raises blood pressure, which increases the risk of stroke in people who already have high blood pressure. Chemicals in cigarette and tobacco smoke lead to the buildup of fatty plaque in the arteries, possibly by injuring the vessel walls. These chemicals also affect cholesterol and levels of fibrinogen, which us a blood-clotting material. This increases the risk of a blood clot that can lead to a heart attack.

Physical Inactivity : People who are not active have a greater risk of heart attack than do people who exercise regularly. Exercise burns calories, helps to control cholesterol levels and diabetes, and may lower blood pressure. Exercise also strengthens the heart muscle and makes arties more flexible. Those who actively burn 500 to 3500 calories per week, either at work or through exercise, can expect to live longer than people who do not exercise. Even moderate-intensity exercise is helpful if done regularly.

Your Gender : Many people think of coronary heart disease as being a male problem. However this is far from being the case. In fact coronary heart disease accounts for more deaths of women than any other any other disease. The female sex hormone, oestrogen, protects against coronary heart disease during the reproductive years by creating a more favourable balance of blood fats and by contributing to the elasticity and health of the arteries. However, after the menopause – or following a total hysterectomy in which the ovaries were also removed as well as the uterus thus depriving the body of oestrogen – this natural protection can disappear.

Heredity : Heart disease tends to run in families. For example, if your parents or siblings had a heart or circulatory problem before age 55, then you are at greater risk for heart disease than someone who does not have that family history. Risk factors (including high blood pressure, diabetes, and obesity) may also be passed from one generation to another.

Age : Older age is a risk factor for heart disease. As we age, our heart tend to not work as well. The heart's walls may thicken, arteries may stiffen and harden, and the heart is less able to pump blood to the muscles of the body. Because of these changes, the risk of developing cardiovascular disease increases with age.

Contributing Risk Factors

Stress : Stress is considered a contributing risk factor for heart disease because little is known about its effects. The effects of emotional stress, behaviour habits, and socioeconomic status on the risk of heart disease and heart attack have not been proven. That is because we all deal with stress differently – how much and in what way stress affects us can vary from person to person. Researchers have identified several reasons why stress may affect the heart.

The increased heart rate and blood pressure that usually comes with a stressful situation can cause an increased demand for oxygen by the heart. This need for oxygen can bring on angina, or chest pain in people who already have heart disease.

During times of stress, the nervous system releases extra hormones (most often adrenaline). These hormones raise blood pressure, which can injure the lining of the arteries. When the arteries heal, the walls may harden or thicken, making it easier for plaque to build up.

Blood clots are more likely to form during times of stress, because clotting is a reaction to stress. Clots may then block an artery narrowed by plaque and cause a heart attack. Stress may also contribute to other risk factors. For example, people who are stressed may overeat for comfort, start smoking, or smoke more than they normally would.

Sex Hormones : Sex hormones appear to play a role in heart disease. Among women younger than 40, heart disease is rare. But between the ages 40 and 65, the chances that a woman will have a heart attack greatly increase. From 65 onward, women make up about half of all heart attack victims.

Researchers have connected this pattern to decreasing amounts of the female hormone estrogen during menopause. Studies have shown that estrogen helps product against heart attacks by raising levels of high-density lipoprotein (HDL) or "good cholesterol" in the blood.

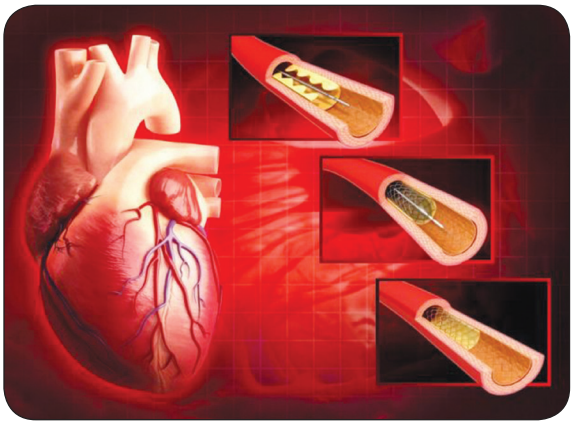
Birth Control Pills : Studies have shown that the use of birth control pills greatly increases the risk of heart disease in women who smoke cigarettes. Some studies have shown that women who smoke and use birth control pills are much more likely to have a heart attack or stroke than are women who neither smoke nor use birth control pills. Women older than 35 who take birth control pills and have other risk factors have an even greater risk.

Alcohol : Studies have shown that the risk of heart disease in people who drink moderate amounts of alcohol is lower than in non-drinkers. Experts say that moderate intake is an average of one to two drinks per day for men and one drink per day for women. One drink is defined as 1 ½ fluid ounces (fl oz) of 80-proof spirits (such as bourbon, Scotch, vodka, gin, etc.) 1 fl oz of 100-proof spirits, 4 fl oz of wine, or 12 fl oz of beer. But drinking more than a moderate amount of alcohol can cause heart-related problems such as high blood pressure, stroke, irregular heartbeats, and cardiomyopathy (disease of the heart muscle.) And the average drink has between 100 and 200 calories. Calories from alcohol often add fat to the body, which may increase the risk of heart disease. It is not recommended that non-drinkers start using alcohol or that drinkers increase the amount that they drink.

It is never too late – or too early – to being improving heart health. Some risk factors can be controlled, while others cannot. But, by eliminating risk factors that you can change and by properly managing those that you cannot control, you may greatly reduce your risk of heart disease.

Coronary Angiography And Angioplasty

What is Coronary Angiography?



It is a procedure that enables heart specialists to look for blockages in the individual arteries that carry blood to your heart muscle. This test combines injecting quantities of dye through a narrow tube inside your heart with taking x-ray pictures from outside. The combination provides your doctor with a clear picture of where your arteries are clogged. Knowing the location of blockages in your arteries helps him or her advise you about the best way to treat your coronary artery disease : medicine, surgery, angioplasty, or stents. Angiography is performed under local anesthesia.

What happens when the test is performed?

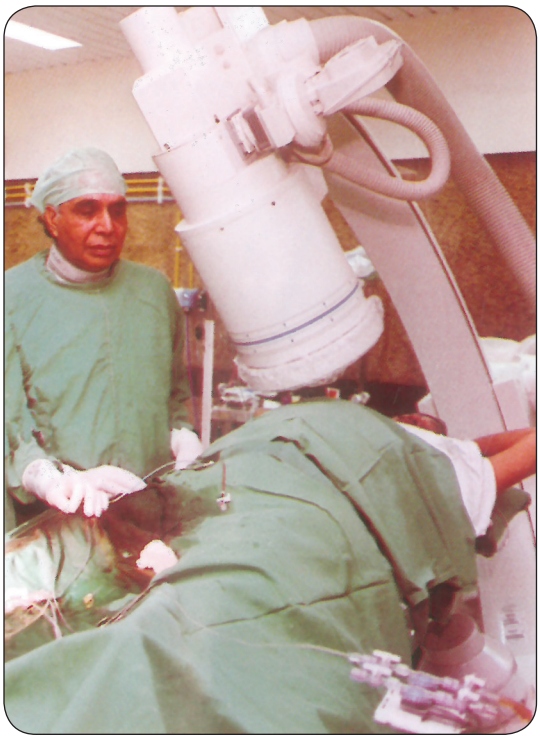
The test is done by a cardiologist using equipment and cameras in a special lab in sterile environment. This lab is known as **Catherization Lab**. You will lie on your back during the procedure. You will be connected to a heart monitor during the test.

A sheath needs to be inserted through the skin into one of the large arteries in either your groin or your neck or arm. Most often, the groin is the place where the sheath is inserted. Before the sheath is placed, a small needle is inserted into your skin, and medicine is injected to numb the skin and underlying tissue in the area. The numbing medicine usually stings for a second. A needle is then inserted and some blood is drawn into a syringe, so that the doctor knows exactly where the blood vessel is located.

One end of a wire is threaded through the needle into the blood vessel, and the needle is then pulled out, leaving the wire temporarily in place. This wire is several feet long, but only a small part of it is inside your artery. Then a small sheath is put over the wire and the wire is removed. The catheter can then be introduced through the sheath.

The doctor will carefully move the catheter along the large artery and through your aorta, into the arteries that deliver blood to your heart (called “coronary arteries).” The catheter shows up on x-rays and the doctor will watch live x-ray pictures on a television to know exactly where the catheter is. While the catheter is pointed into each of the coronary arteries the doctor will inject a special dye through the catheter; this is a dye that shows up well on x-rays.

X-ray pictures (a video) will be taken while the dye travels along and outlines all of the blood



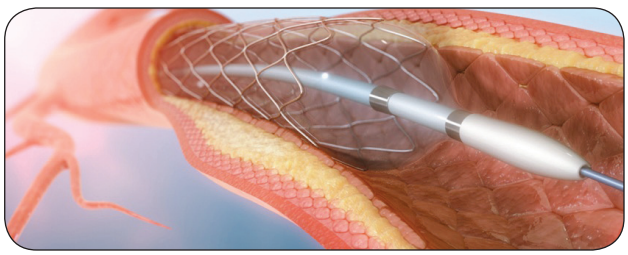
vessels in the heart muscle through which it flows. The arteries show up as white lines on the x-ray. A narrowing or blockage in an artery will make that artery look like a thinner line on the x-ray compared to your other arteries. Your doctor can also inject some dye from the catheter into the left ventricle of your heart to see its outline. This way the x-ray can show how well your heart is squeezing with each heartbeat.

At the conclusion of the procedure, this sheath is pulled out and pressure is applied at the puncture site to achieve hemostasis. The pressure is applied for roughly 15 minutes. Bed rest is required for 6 hours. After that resting, activity is resumed gradually and patients are discharged home 7 to 8 hours after angiography if there is no complication. Patients with diabetes may need additional precautions including a change in their diabetic medications on an individual basis.

Some More Facts About Coronary Angiography

- It requires hospitalization for 8 hours.
- Angiography is performed under local anesthesia.
- The procedure itself takes between 15 to 20 minutes
- Following angiography it is necessary to stay in bed for 6 hours to allow for adequate healing of the puncture site.
- It is important to discuss allergies with your physician prior to angiography, especially if there are any allergies to iodine or seafood.

Balloon / Stent Angioplasty



While still on the angiographic table, your doctor may choose to unblock your narrowed coronary artery by carrying out a coronary

Percutaneous Transluminal Coronary Angioplasty (PTCA). This procedure is commonly known as Angioplasty.

Angioplasty refers to a technique of dilating (opening) significantly blocked arteries from inside thus avoiding the need for much more extensive surgical intervention.

A catheter similar to the one used for angiography is used. Through this catheter a fine wire (1/1400 of an inch) is passed into the coronary artery. Over this wire, a doctor inserts a catheter with a deflated balloon at its tip into the narrowed part of the artery.

Then the balloon is inflated at the site of the blockage, compressing the plaque and enlarging the inner diameter of the blood vessel so blood can flow more easily. Then the balloon is deflated and the catheter removed. It is a less traumatic and less expensive alternative to bypass surgery for some patients with coronary artery disease.

Your doctor may choose to insert a stent in the dilated coronary artery. A stent is a specially designed metal mesh that is introduced on a balloon that can be selectively pressurized. The stent is positioned in the middle of the blockage and the balloon inflated. This forces the stent open against the wall of the artery. The stent is designed to remain open after the balloon is deflated and the catheter removed.

This holds the artery open. The stent stays in the artery permanently, holds it open, improves blood flow to the heart muscle and relieves symptoms (usually chest pain).

At the conclusion of the procedure, patients are generally transferred to the ICCU for monitoring and treatment. After monitoring for 24 hours, patients are usually ready for discharge the following day.

Facts About Stent Procedure :

What is a stent?

This procedure uses a wire mesh tube (a stent) to prop open an artery that is recently been cleared using angioplasty. The stent is collapsed to a small diameter and put over a balloon catheter. It is then moved into the area of the blockage. When the balloon is inflated, the stent expands, locks in place and forms a scaffold. This holds the artery open.

When are stents used?

This is fairly a common procedure. In fact, stents are used in 70-90 percent of Angioplasty procedures. Stents are used depending on certain features of the artery blockage. This includes the size the artery and where the blockage is.

What are the advantages of using a stent?

In certain patients, stents reduce the renarrowing that occurs after balloon angioplasty or other procedures that use catheters. Stents also help restore normal blood flow and keep an artery open if it is been torn or injured by the balloon catheter.

Can stented arteries reclose?

Yes. Reclosure (restenosis) is also a problem with the stent procedure in 10% to 15% of the cases. In recent years doctors have used new types of stents. Some of these are covered with drugs that help keep the blood vessel from reclosing. These new drug coated stents have shown a lot of promise for improving the long-term success of this procedure and it is now possible to treat 80% to 90% of blockages with Angioplasty procedure.

What precautions should be taken after a stent procedure?

Patients who have had a stent procedure must take one or more blood-thinning agents. Examples are aspirin and ticlopidine or clopidogrel. Aspirin is used indefinitely; one of the other two drugs is used for two to four weeks. (These medicines are to be used under a doctor's guidance, strictly.) For the next four weeks a magnetic resonance imaging (MRI) scan should not be done without a cardiologist's approval. But metal detectors do not affect the stent.

Can having a stent cause problems later?

To date, there is no evidence of long-term complications from having a permanent stent.

What is a drug eluting stent?

With conventional stents, renarrowing of arteries can occur because implantation of stents can trigger proliferation of the tissue that makes up the arterial lining. This is the major cause of narrowing (intent restenosis) which can lead to reappearance of the symptoms of angina. Drug eluting stents have shown a lot of promise in reducing the chances of instent restenosis in a vast majority of cases.

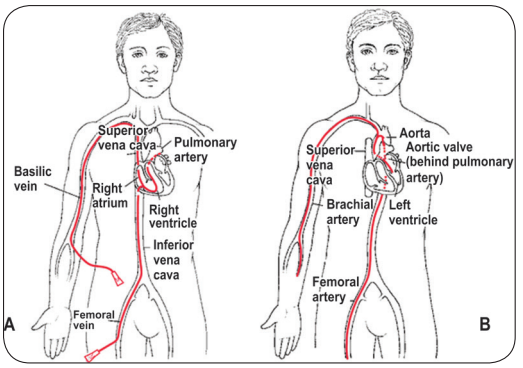
These stents have a special coating of polymer that controls the release of special drug over a period of several weeks once implanted at the blocked area of the artery. The intention of this time-release process is to slow down the unwanted growth of cells (restenosis) which causes reblockage of stents and allow the artery to heal.

The Drug Eluting stent that has been found to be most effective and safe currently with more than 4 years follow up in Clinical Trials is the sirolimus Eluting stent. This FDA approved stent is available in India and successfully implanted in more than 20,000j Indian patients and is used extensively all over the world.

Benefits of PTCA/STENTJ PTCA

- "Normalization" of internal arterial lumen with a minimally invasive technique.
- Brief procedure downtime.
- Avoidance of extensive surgery.
- Easy to repeat, of necessary.
- Symptomatic relief with improvement in quality.
- Reduction in medications following a successful outcome.

Radial Approach



The femoral (groin) artery, the traditional entry site, is the most appealing approach for coronary angiography as well as angioplasty, because of ease of arterial cannulation and catheter manipulation.

However, there are several important limitations associated with this entry site. The femoral artery runs deep under the skin, specially in obese patients. Following removal of arterial sheath, after angioplasty bleeding complications, though uncommon, are difficult to prevent, particularly in obese patients, despite careful and prolonged immobilisation. Patient is immbolised on bed for six hours after angiography and twelve hours after angioplasty, which is another limiting factor for femoral approach.

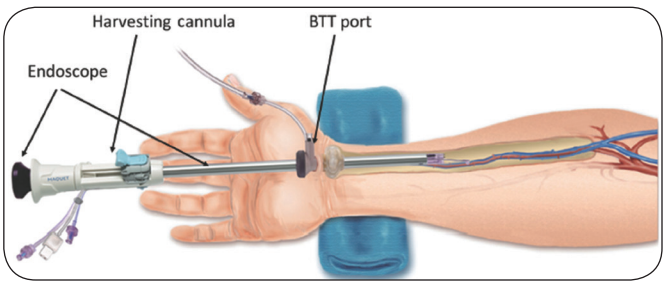
A newer approach, the radial approach (wrist artery) is potentially safer entry site for several reasons. The superficial course of this artery facilitates haemostasis (stoppage of bleeding), by simple application of pressure bandage over the puncture site. (Important bleeding is immediately noticed by the patients, who can atleast temporarily address this problem by himself. This is one of reasons that blood loss is usually minimal.

Since the median nerve is well separated from the artery and there is no major vein in the vicinity, the chances of arterio venous fistula or nerve damage are rare.

However, this radial approach of coronary angiography and angioplasty is technically more demanding as compared to the traditional femoral approach since radial artery size is smaller and has a tendency to go in to the spasm.

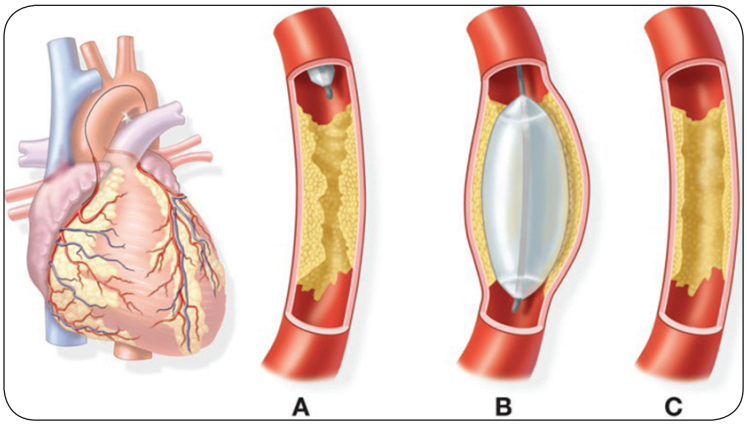
The reward of this effort will be apparent after the procedure since less man power is required to obtain haemostasis and hence bleeding complications are very uncommon. One of the most striking advantages is the free and immediate ambulation of the patients, which is greatly appreciated in most striking advantages is the free and immediate ambulation of the patients, which is greatly appreciated in most instances.

Free mobilisation with less risk for bleeding, opens the way to outpatient or day care coronary angiography and angioplasty, resulting in reduced cost and increased efficiency with patient comfort.



Life After Angioplasty

What can I expect immediately after the procedure?



At the conclusion of the angioplasty procedure, sheath is pulled out in 2 to 4 hours and firm pressured is applied at the puncture site for about 15 minutes Medical personnel will continue monitoring your vital signs, and you will have to lie as still as possible, with your legs straight, for 7 to 8 hours. Your blood pressure and pulse will be checked frequently for several hours. If your cardiologist recommends it, you will be connected to a heart monitor.

How can I take care of myself immediately after PTCA?

The insertion site will be examined often. If you notice any bleeding, discomfort swelling or numbness, inform your doctor immediately. You will be asked to drink plenty of fluids to help flush the dye contrast out of your system.

When will I be able to eat?

You may have something to eat and drink as soon as you return to your room.

When can I go home?

Most angioplasty patients will stay in the hospital for one or two days, so that all your vital signs can be monitored. How long you stay depends on your medical condition. Upon discharge, your doctor will go over the results of your procedure, medication changes, activities, and follow-up care.

Will my activity be restricted?

You should not lift anything heavy for 24-48 hours, limit the number of times you go up and down the stairs and avoid bending as much as possible for 24 hours. Person should be able to resume his normal activities within 3-4 days unless instructed otherwise.

Can the stent move inside the artery?

If implanted properly, stent can never move inside the artery.

Will I be on a special diet?

You will need to be on a healthy-heart diet (low fat, low cholesterol and low sodium). If you have questions about diet, see your dietician.

When can I drive?

You will be able to drive 24-48 hours after the procedure unless otherwise instructed. Ask your doctor when you may return to work and resume normal activities.

When can I have sex?

You may resume intimate relations when you return home unless otherwise instructed.

When can I take a shower?

You may shower when you are able to get out of bed. You should not take a tub bath or swim for 48 hours so that the clot that has formed over your insertion site will not be dislodged.

Do not smoke for at least 48 hours.

Follow up care :

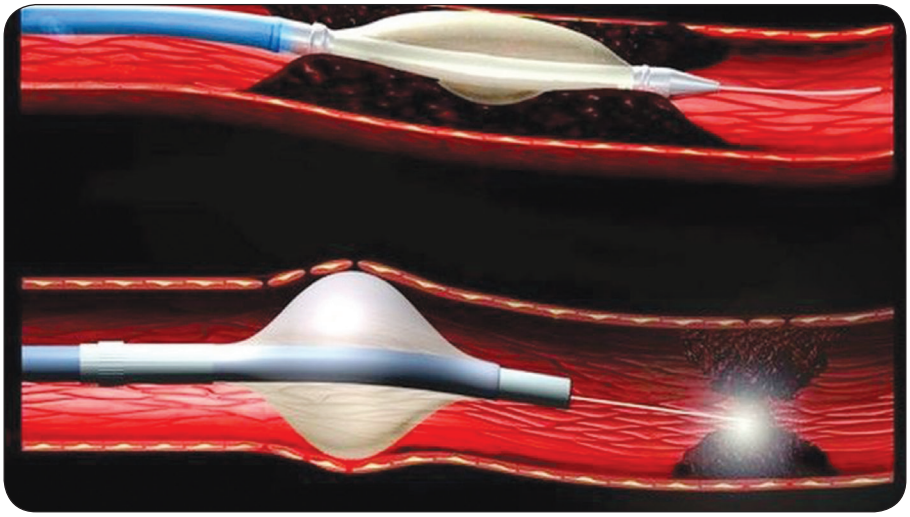
Many doctors want to see the angioplasty patients at least once during the weeks immediately after the procedure to be sure they are doing well. To determine the extent of the success of your PTCA, you will usually undergo a low-level stress test usually after 6 months. You will be informed by the doctor or nurse when this will be. The stress test will show the doctor how much blood if flowing to hour heart and it will serve as a guide for your exercise program.

Medication :

Cardiac medications have shown to decrease the chance of future adverse events such as heart attack. However, these medicines should be taken under strict guidance of a physician. After angioplasty, patients typically take clopidogrel for 2 4 weeks after thes procedure to help prevent clotting. Most patients also take low dose aspirin therapy for life. Other medications – including an angiotensin – converting enzyme (ACE) inhibitor, beta-blocker, calcium channel blocker, and statin – may also be needed. 4 weeks after the procedure to help prevent clotting. Most patients also take low dose aspirin therapy for life. Other medications – including an angiotensin-converting enzyme (ACE) inhibitor, beta-blocker, calcium channel blocker, and statin – may also be needed.

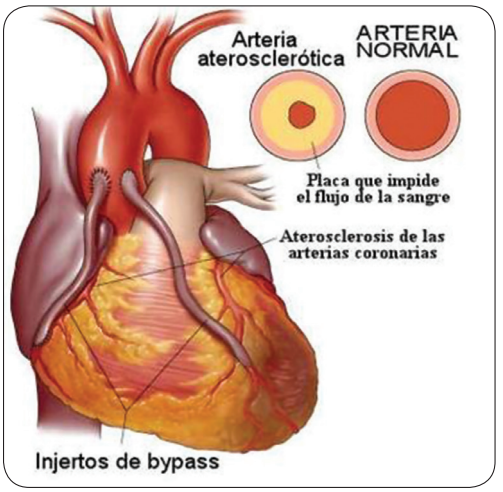
Changes in your lifestyle:

Low fat, low cholesterol, high fiber diet, no smoking, regular exercise can improve levels of "good" (HDL) cholesterol in the blood may help control some types of diabetes, lead to modest reduction in blood pressure, and even reduce the chance of having a heart attack in the future. Patients should be sure to consult with a physician for help in devising an exercise program before beginning to exercise. The doctor may refer the patient to one of the organized cardiac rehabilitation programs available at many hospitals and community centers.



Bypass Surgery

What is coronary artery bypass surgery?



Coronary artery bypass surgery is the surgical procedure by which blocked portion of coronary artery is bypass in order to restore adequate circulation to the cardiac muscle.

For this purpose grafts are taken from :

a) Internal mammary arteries from the chest, or

b) Inferior epigastric or gastro-epiploic artery from the abdomen, or

c) Radial artery from the arms, or

d) Saphenous vein from legs. This does not affect the blood flow to the leg as other veins take over the function of the saphenous vein.

The grafting is done as shown in these diagrams:

A particular section of patients who have critical, highly diffused and multiple blocks are generally benefitted by bypass surgery.

The bypass operation

After giving general anesthesia, surgeon reaches patient's heart by cutting his breast bone (also known as sternum). Before carrying on the actual grafting, patient's heart may be cooled and stopped and the blood is passed through a heart-lung machine. This machine takes over the function of the lungs and the heart i.e. it oxygenates the blood and pumps it to the rest of the body.

However, most bypass surgeries are now-a-days performed without stopping the heart and without using the heart-lung machine. This is known as 'beating heart surgery'. This procedure involves stabilizing the portion of the artery to be grafted with a device called the 'octopus'.

In many cases, the left internal mammary artery and the right internal mammary artery are used for total revascularization. In case these arteries are not suitable or if the surgeon decides to take additional graft, he can take the radial artery from the arm or saphenous vein from the legs.

After the surgery, sternum is put back together by wires. These wires stay in the chest forever and do no harm. Sternum takes several weeks to heal and the patient may get pain in chest,

neck and back. Discomfort may also be experienced in arms or legs where incisions were taken during the surgery. This pain will subside with time. There may be slight swelling of these parts for a few days.

After the operation

From the operation theatre you are taken to the recovery room where you will remain for 48 hours. It is here that you will regain consciousness and begin you recovery. When you wake up there will be a tube in your mouth (endotracheal tube) which prevents you from talking. This tube is attached to a ventilator (breathing machine) which helps you to breathe till anaesthesia wears off. The nurses may have suck mucus from your mouth while the endotracheal tube is in place. This may give rise to coughing or choking during the process of suction. Don't worry, this is perfectly normal. Mucus gets collected mainly because anaesthesia depresses lung function and natural process of mucus clearance is inhibited.

Once you are breathing well on your own, the endotracheal tube is removed and additional oxygen is administered to you by means of a mask.

A urinary catheter is kept in place for 2-3 days to drain the bladder. Leads attached to your body will monitor your recovery and intravenous lines will help to administer drugs and fluids. Arterial line is placed in the wrist for 1-2 days to monitor blood pressure and measure the oxygenation of blood.

On the way to recovery

The surgical incision will be checked regularly by the doctors and nurses for leakage of blood or clear fluid.

After 3 to 4 days of surgery, a physiotherapist will give you treatment, including turning on your sides, making you do breathing and coughing exercises and helping you sit on the bed. You will also be taught exercises of the wrists, ankle, arms and legs. Your activities will be increased slowly from initial turning from side to side, to sitting in the bed, to sitting in chair and later walking for few steps.

As your recovery continues, you will increase your tolerance and independence at a rate unique to you and your body. Making steady progress is important but you need not push yourself too hard.

You will be required to wear an elastic bandage or elastic stockings on your legs in order to reduce swelling and accelerate blood return from the legs to the heart. Additionally, an elastic binder will be needed to support the chest and relieve the pain of the incision.

Return to work

You will need 5 to 6 weeks to completely recover from your heart surgery. Most persons are able to return to work in 2 months of their surgery. You may initially perform some light jobs for few days for shorter durations and gradually increase volume of your work.

Cardiac Pacemakers

What is a cardiac pacemaker?

A pacemaker is a surgically implanted electronic device that regulates a slow or erratic heartbeat.

What is its purpose?

The average heart rate is 60 to 100 beats per minute. There are areas in the heart called natural pacemakers that send electrical signals to the rest of the heart, setting the speed or pace of he heartbeat. They help it speed up during exercise or hard wok, and to slow down during rest.

Sometimes the natural pacemaker of the heart becomes diseased and does not keep the heart beating regularly. This condition in which heart beats too fast or too slow is known as cardiac arrhythmia. It can cause serious problems such as congestive heart failure. One way of controlling an arrhythmia is through the use of medications. If medications fail to regulate the heartbeat, physicians often advise the patient to have pacemaker implanted in the chest wall.

How is a pacemaker implanted?

A pacemaker is generally implanted by a cardiologist in the Cardiac Catheterization Laboratory. During the procedure the patient lies on an x-ray table and his electrocardiogram (ECG) is continually monitored. A pacemaker is usually implanted under local anesthesia. The implantation site over a large vein, usually in the upper chest, is scrubbed and draped to preserve sterility.

An artificial pacemaker is a small unit that uses batteries to produce the electrical signals that make the heart pump. Attached to the battery are two leads that connect it with the heart. The pacemaker is implanted under the skin of the chest wall, and the leads are threaded through a vein near the collarbone and guided to the heart muscle.

Once implanted and activated, the artificial cardiac pacemaker regulates heartbeats by sending electrical impulses to the heart muscle.

The pacemaker is programmed by the cardiologist. It can be placed on the right side or the left side of the chest.

Pacemakers may be either single chamber (either atrium or ventricle) or dual chamber (both atrium and ventricle).

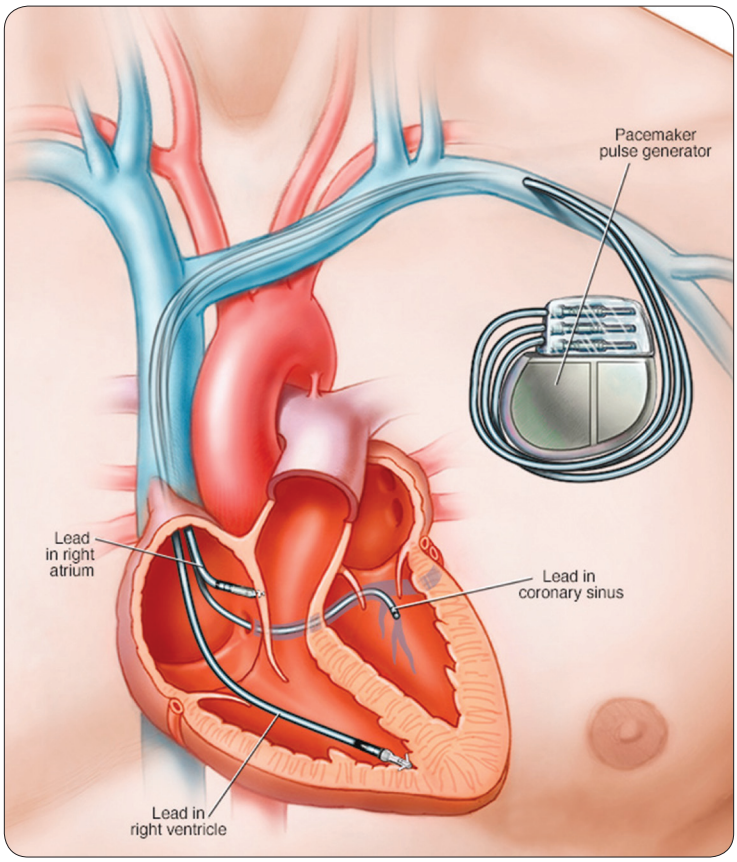
There will be a light bandage over the incision and you will usually stay overnight afters the implantation. Light activity may be resumed soon after implantation and full activity within two to four weeks.

Life after implantation of a cardiac pacemaker

Pacemaker patients should schedule a follow-up visit with their cardiologist approximately 6 weeks after the implantation. Doctor may make few necessary adjustments to the settings of the pacemaker. Pacemaker batteries must be checked regularly.

To varying degrees, all pacemakers are sensitive to electrical interference from microwaves, electrical generators and similar equipment, depending upon how well-shielded they are.

Individuals are encouraged to carry a letter or identification card stating that they have an artificial cardiac pacemaker.



Low Fat, Low Carbohydrate Diet

Eating a well-balanced diet that includes plenty of fresh fruits, Vegetables and whole grains is just the beginning of living a healthy, nutritious lifestyle.

When selecting foods, it is important to remember the amount of total saturated fatty acids, cholesterol, fat and sodium these foods may add to your daily menu. Choose foods low in saturated fatty acids, cholesterol and sodium. Avoid meat, eggs and dairy products.

No matter which eating plan you follow the following guidelines are recommended:

- Total fat intake should be less than 30 percent of total calories daily.
- Saturated fatty acid intake should be less than 10 percent of total calories daily.
- Polyunsaturated fatty acid intake should be no more that 10 percent of total calories daily.
- Monounsaturated fatty acids make up the rest of total fat intake, about 10 to 15 percent of total calories daily.
- Cholesterol intake should be no more than 300 milligrams per day.
- Sodium intake should be no more than 3000 milligrams per day.
- Beware of chemicals in your food like caffeine, and other food additives.
- Don't forget that you can enjoy the taste of eating right. Healthy heart foods can be delicious!

Do's and Don't's

Do's

- Intake of plenty of leafy vegetables, raw salads, soup (clear) are recommended.
- Fruits should be consumed preferably with their skins.
- Fish and chicken can be taken in grilled, baked, roasted form. However, fried preparations should be avoided. Always steam the vegetables before giving the seasoning so as to reduce the total fat consumption.
- Intake of 2 to 3 teaspoon of oil per day is recommended.
- Intake of raw garlic (30 gm) per day is preferable.
- Use of skimmed milk is recommended.

Dont's

- Avoid fried foods, rich pastries, cakes pudding, sweets, meat, etc.
- Avoid dry fruits, coconut, papads, pickles, wafers, chips farsans, nuts, cheese, etc.
- Avoid red meat, organ meat like kidneys, brain, liver, egg yolk.
- Restrict the intake of bakery products.
- Avoid keeping salt at the dining table.
- Avoid whole milk and products made of whole milk, dairy products.

Sample Diet

Bed Tea :	1 cup tea/coffee using skimmed milk ¼ cup
Breakfast :	1 cup skimmed milk
	1 katori vegetable poha or 1 katori vegetable upma or 2 idlis with ½ katori sambhar or 5-6 pieces dhokla or 2 khakharas (dry) or 1 katori vermicelli upma or 1 bowl porridge (made from 3 tablespoons oats / daliya / sooji using milk) or 2 slices whole-wheat bread.
Note :	*1 cup skimmed milk may be exchanged for 2 egg whites only which can be had as boiled / omelette / scrambled.*
Mid-Morning :	1 Fruit
Lunch :	1-2 bowls vegetable soup, 2 phulkas (dry), ½ katori rice, 1 katori dal or ½ katori sprouts, 1-2 katories vegetables, 1 katori curd or vegetable raita or 2 katories kadi or 1 glass buttermilk, pleanty of salad : red tomato, cucumber, carrot, beetroot, cabbage, red and white raddish, garlic, capsicum, lettuce, mushroom, baby corn, celery, onions.
Add to salad :	*spices, herbs and condiments of choice + lime / vinegar / tamarind / amchur.*
Omit in salad :	Oil, ghee, salad oil, coconut, peanuts dry fruits, fruits, sugar, jaggery, honey.
Note :	1 katori curd may be exchange for 2 egg whites or 2 slices fish or 1 piece chicken (without skin).
Evening Tea :	1 cup tea/coffee using skimmed milk ¼ cup. Snacks similar to breakfast or 1 katori kurmura + roasted channa or 3 whole wheat bran crackers.
Mid-Evening :	1 fruit
Dinner :	Same as lunch
Bedtime :	1 fruit
Note :	*Oil allowance per day : 4 teaspoons (20 gms)*
	Capacity of cup and katori : 150 ml
	Capacity of teaspoon : 5 gms

Exercise for a Healthier Heart

Prevention approaches

Prevention is always better than cure. This section outlines things you can do to help yourself to a healthier heart. Even if you've already been diagnosed with heart disease, making lifestyle changes can help you live a longer, healthier and more enjoyable life.

Adopting a healthier lifestyle is not about denying the things you enjoy, make vast changes such as joining a gym, becoming a vegetarian or eating nothing but 'health foods.' Small, easily achievable adaptations such as becoming more active in your everyday life and learning to enjoy fresh, wholesome food can make a tremendous difference to your wellbeing and improve the health of your heart.

Best of all, most of the steps outlined improve several different risk factors. For example becoming more active helps to reduce your blood pressure, improves your cholesterol level and by boosting your metabolism, helps control your weight-all of which can significantly reduce your risk of coronary heart disease.

Activity

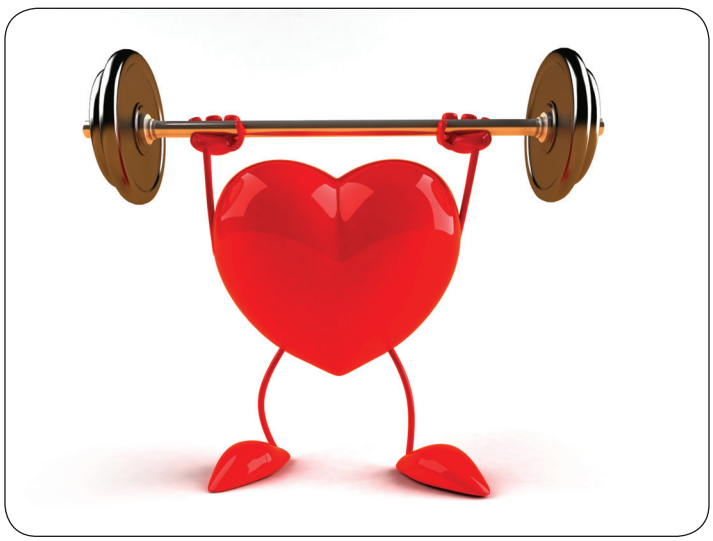
It is important that you visit your Physician before you start any exercise programme.

Being active is absolutely essential for a healthy heart – for the simple reason that your heart is a muscle. Even if you haven't been active for some time, your heart can become stronger, so that it is able to pump more efficiently giving you more stamina and greater energy.

Becoming more active will also improve the ability of your body's tissues to extract oxygen from your blood help you maintain healthy levels of blood fats and speed your metabolism.

Types of exercise

Three types of exercise are needed in order to become fitter and healthier. These are aerobic, resistance training and flexibility. All three are vital for all-round fitness.



Aerobic exercise (cardiovascular)

Particularly important to prevent coronary heart disease is aerobic or cardiovascular exercise.

This is any kind of activity that increases your breathing rate and gets you breathing more deeply. These activities include : walking, running, swimming, dancing or any of the aerobic (cardiovascular) machines at the gym such as the rowing machine, treadmill, stepper elliptical trainer.

These are designed to increase the strength of your heart muscle by improving your body's ability to extract oxygen from the blood and transport it to the rest of the body. Aerobic exercise also enhances your body's ability to use oxygen efficiently and to burn (or metabolise) fats and carbohydrates for energy.

Strength exercise (resistance training)

Strength exercise (or resistance training) helps to make your muscles stronger, strengthens your bones and protects your joints from the risk of injury (because muscles protect the joints). This type of exercise may involve the use of free weights and weights machines such as those found in the gym - or any kind of activity in which you load your muscles. For example, carrying heavy shopping bags or exercises such as press-up lunges and squats, and some of the exercises involved in yoga which use your body weight, are all good for resistance.

Resistance training does not increase the fitness of your heart like aerobic exercise. What it can do is help control your weight because muscular tissue burns more calories than fat. This type of exercise is not recommended for people with uncontrolled high blood pressure of heart disease; so if you are affected, check with your doctor.

Stretching

Stretching helps relax and lengthen your muscles, encourages improved blood flow, and helps keep you supple so you can move more easily. Experts say it is good to stretch for 5 to 10 minutes every day. There are a number of simple stretches which you will find in virtually and book about exercise or can be taught by the instructor at the gym.

If you want more organised stretching, yoga and Pilates are safe and gentle for people with heart problems, as they help calm the mind and body and reduce stress. Yet, there may still be some exercises or postures that are not recommended if you have heart disease, so check with your doctor first and tell your instructor if you have high blood pressure or heart disease.

Getting started

There is no need to join a gym or take part in organised sport, unless you want to, of course. Simply incorporating more activity into your daily life and doing activities like walking, gardening, cycling and incorporating more activity into your daily life can be just as effective as a structured exercise programme.

Your aim should be to be moderately active for 30 minutes most days of the weeks. If you

find it hard to fit this into your life, split it up into shorter periods. You should feel that your heart rate is increasing, you are breathing more deeply and frequently. You should be able to walk and talk at the same time – if you can't then the activity is too strenuous.

Safety First

If you experience any or all of the following, stop exercising and consult your doctor.

- Chest pain (see angina).
- Dizziness, light-headedness or confusion.
- Nausea or vomiting.
- Cramp-like pains in the legs (intermittent claudication).
- Pale or bluish skin tone.
- Breathlessness lasting for more than 10 minutes.
- Palpitations (rapid or irregular heart beat). Continued fatigue (lasting for 24 hours or more).
- Fluid retention (Swollen ankles, sudden weight gain).

Rest and relation

Anxiety and other reactions to stress can affect the blood vessels and the heart and, although the role of stress in coronary heart disease is controversial and thought by some experts to be over-rated, it can certainly do you no harm to learn to relax and manage stress more effectively.

All of us have to contend with major life events from time to time such as a divorce, bereavement, job loss or financial problems. However, there is also a wide range of everyday events (being stuck in traffic, a row with your partner or a disagreement with someone at work) that can be stressful – and these everyday irritations may be even more stressful because they are constant.

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Ways to manage stress

Keep a diary : note down stressful situations and your reaction to them. This will help you

identify the ones that are most stressful to you, so can begin to change your reactions.

Stay positive : your thoughts control your feelings. If you stop and listen to your thoughts, you may be surprised to discover how negative they are. Replacing negative thoughts with positive thoughts will help you deal with stressful situations more calmly.

Learn to relax : pay attention to your posture and consciously relax physically. You may also want to try a technique such yoga, massage, meditation or other complementary therapies.

Get as much sleep as you need: we all need different amounts of sleep and you will know how much you need to feel refreshed. Try to get this amount of sleep most nights.

Tip for healthy heart

It is of paramount importance to avoid stress as far as possible in addition to dietary and other life style modifications to prevent coronary heart disease.

It is not always possible to avoid stress but one has to change attitude towards life through spiritual practices such as meditation and yoga.