

# Angina pectoris essay



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## INTRODUCTION

In today's society, people are gaining medical knowledge at quite a fast pace. Treatments, cures, and vaccines for various diseases and disorders are being developed constantly, and yet, coronary heart disease remains the number one killer in the world. The media today concentrates intensely on drug and alcohol abuse, homicides, AIDS and so on. What a lot of people are not realizing is that coronary heart disease actually accounts for about 80% of all sudden deaths.

In fact, the number of deaths from heart disease approximately equals to the number of deaths from cancer, accidents, chronic lung disease, pneumonia and influenza, and others, COMBINED. One of the symptoms of coronary heart disease is angina pectoris. Unfortunately, a lot of people do not take it seriously, and thus not realizing that it may lead to other complications, and even death.

## THE HUMAN HEART

In order to understand angina, one must know about our own heart. The human heart is a powerful muscle in the body which is worked the hardest.

A double pump system, the heart consists of two pumps side by side, which pump blood to all parts of the body. Its steady beating maintains the flow of blood through the body day and night, year after year, non-stop from birth until death. The heart is a hollow, muscular organ slightly bigger than a person's clenched fist. It is located in the centre of the chest, under the breastbone above the sternum, but it is slanted slightly to the left, giving

people the impression that their heart is on the left side of their chest. The heart is divided into two halves, which are further divided into four chambers: the left atrium and ventricle, and the right atrium and ventricle. Each chamber on one side is separated from the other by a valve, and it is the closure of these valves that produce the “lubb-dubb” sound so familiar to us.

(see Fig. 1 - The Structure of the Heart) Like any other organs in our body, the heart needs a supply of blood and oxygen, and coronary arteries supply them.

There are two main coronary arteries, the left coronary artery, and the right coronary artery. They branch off the main artery of the body, the aorta. The right coronary artery circles the right side and goes to the back of the heart.

The left coronary artery further divides into the left circumflex and the left anterior descending artery. These two left arteries feed the front and the left side of the heart. The division of the left coronary artery is the reason why doctors usually refer to three main coronary arteries. (Fig. 2 - Coronary Arteries)  
**SYMPTOMS OF CORONARY HEART DISEASE** There are three main symptoms of coronary heart disease: Heart Attack, Sudden Death, and Angina.

**Heart Attack** Heart attack occurs when a blood clot suddenly and completely blocks a diseased coronary artery, resulting in the death of the heart muscle cells supplied by that artery. Coronary and Coronary Thrombosis<sup>2</sup> are terms that can refer to a heart attack. Another term, Acute myocardial infarction<sup>2</sup>, means death of heart muscle due to an inadequate blood supply. Sudden

Death Sudden death occurs due to cardiac arrest. Cardiac arrest may be the first symptom of coronary artery disease and may occur without any symptoms or warning signs. Other causes of sudden deaths include drowning, suffocation, electrocution, drug overdose, trauma (such as automobile accidents), and stroke.

Drowning, suffocation, and drug overdose usually cause respiratory arrest which in turn cause cardiac arrest.

Trauma may cause sudden death by severe injury to the heart or brain, or by severe blood loss. Stroke causes damage to the brain which can cause respiratory arrest and/or cardiac arrest. Angina People with coronary artery disease, whether or not they have had a heart attack, may experience intermittent chest pain, pressure, or discomforts. This situation is known as angina pectoris. It occurs when the narrowing of the coronary arteries temporarily prevents an adequate supply of blood and oxygen to meet the demands of working heart muscles.

**ANGINA PECTORIS** Angina Pectoris (from angina meaning strangling, and pectoris meaning breast) is commonly known simply as angina and means pain in the chest. The term "angina" was first used during a lecture in 1768 by Dr. William Heberden. The word was not intended to indicate "pain," but rather "strangling," with a secondary sensation of fear. Victims suffering from angina may experience pressure, discomfort, or a squeezing sensation in the centre of the chest behind the breastbone. The pain may radiate to the arms, the neck, even the upper back, and the pain may come and go.

It occurs when the heart is not receiving enough oxygen to meet an increased demand.

Angina, as mentioned before, is only temporarily, and it does not cause any permanent damage to the heart muscle. The underlying coronary heart disease, however, continues to progress unless actions are taken to prevent it from becoming worse. Signs and Symptoms Angina does not necessarily involve pain.

The feeling varies from individuals. In fact, some people described it as “ chest pressure,” “ chest distress,” “ heaviness,” “ burning feeling,” “ constriction,” “ tightness,” and many more. A person with angina may feel discomforts that fit one or several of the following descriptions: - Mild, vague discomfort in the centre of the chest, which may radiate to the left shoulder or arm - Dull ache, pins and needles, heaviness or pains in the arms, usually more severe in the left arm - Pain that feels like severe indigestion - Heaviness, tightness, fullness, dull ache, intense pressure, a burning, vice-like, constriction, squeezing sensation in the chest, throat or upper abdomen - Extreme tiredness, exhaustion or a feeling of collapse - Shortness of breath, choking sensation - A sense of foreboding or impending death accompanying chest discomfort - Pains in the jaw, gums, teeth, throat or ear lobe - Pains in the back or between the shoulder blades Angina can be so severe that a person may feel frightened, or so mild that it might be ignored.

Angina attacks are usually short, from one or two minutes to a maximum of about four to five.

It usually goes away with rest, within a couple of minutes, or ten minutes at the most. Different Forms of Angina There are several known forms of angina. Brief pain that comes on exertion and leave fairly quickly on rest is known as stable angina. When angina pain occurs during rest, it is called unstable angina. The symptoms are usually severe and the coronary arteries are badly narrowed.

If a person suffers from unstable angina, there is a higher risk for that person to develop heart attacks. The pain may come up to 20 times a day, and it can wake a person up, especially after a disturbing dream. Another type of angina is called atypical or variant angina. In this type of angina, pain occurs only when a person is resting or asleep rather than from exertion. It is thought to be the result of coronary artery spasm, a sort of cramp that narrows the arteries.

Causes of Angina The main cause of angina is the narrowing of the coronary arteries. In a normal person, the inner walls of the coronary arteries are smooth and elastic, allowing them to constrict and expand.

This flexibility permits varying amounts of oxygenated blood, appropriate to the demand at the time, to flow through the coronary arteries. As a person grows older, fatty deposits will accumulate on the artery walls, especially if the linings of the arteries are damaged due to cigarette smoking or high blood pressure. As more and more fatty materials build up, they form plaques which causes the arteries to narrow and thus restricting the flow of blood. This process is known as atherosclerosis.

However, angina usually does not occur until about two-thirds of the artery's diameter is blocked. Besides atherosclerosis, there are other heart conditions resulting in the starvation of oxygen of the heart, which also causes angina.

The nerve factor - The arteries are supplied with nerves, which allow them to be controlled directly by the brain, especially the hypothalamus - an area at the centre of the brain which regulates the emotions.

The brain controls the expanding and narrowing of the arteries when necessary. The pressures of modern life: aggression, hostility, never-ending deadlines, remorseless, competition, unrest, insecurity and so on, can trigger this control mechanism.

When you become emotional, the chemicals that are released, such as adrenaline, noradrenaline, and serotonin, can cause a further constriction of the coronary arteries. The pituitary gland, a small gland at the base of the brain, under the control of the hypothalamus, can signal the adrenal glands to increase the production of stress hormones such as cortisol and adrenaline even further. Coronary spasm - Sudden constrictions of the muscle layer in an artery can cause platelets to stick together, temporarily restricting the flow of flow.

This is known as coronary spasm.

Platelets are minute particles in the blood, which play an essential role both in the clotting process and in repairing any damaged arterial walls. They tend to clump together more easily when the blood is full of chemicals released during arousal, such as cortisol and others. Coronary spasm causes the platelets to stick together and to the wall of the artery, while substances

released by the platelets as they stick together further constrict the blood vessels. If the artery is already narrowed, this can have a devastating effect as it drastically reduces the blood flow. (Fig. 3 - Spasm in a coronary artery)

When people are very tense, they usually overbreathe or hold their breath altogether.

Shallow, irregular but rapid breathing washes out carbon dioxide from the system and the blood will become over-oxygenated. One might think that the more oxygen in the blood the better, but overloaded blood actually does not give up oxygen as easily, therefore the amount of oxygen available to the heart is reduced. Carbon dioxide is present in the blood in the form of carbonic acid, when there is a loss in carbonic acid, the blood becomes more basic, or alkaline, which leads to spasm of blood vessels, almost certainly in the brain but also in the heart.

## ATHEROSCLEROSIS

The coronary arteries may be clogged with atherosclerotic plaques, thus narrowing the diameter. Plaques are usually collections of connective tissue, fats, and smooth muscle cells. The plaque projects into the lumen, the passageway of the artery, and interfere with the flow of blood.

In a normal artery, the smooth muscle cells are in the middle layer of the arterial wall; in atherosclerosis they migrate into the inner layer. The reason behind their migration could hold the answers to explain the existence of atherosclerosis. Two theories have been developed for the cause of atherosclerosis. The first theory was suggested by German pathologist



Rudolf Virchow over 100 years ago. He proposed that the passage of fatty material into the arterial wall is the initial cause of atherosclerosis. The fatty material, especially cholesterol, acts as an irritant, and the arterial wall respond with an outpouring of cells, creating atherosclerotic plaque.

The second theory was developed by Austrian pathologist Karl von Rokitansky in 1852. He suggested that atherosclerotic plaques are aftereffects of blood-clot organization (thrombosis).

The clot adheres to the intima and is gradually converted to a mass of tissue, which evolves into a plaque. There are evidences to support the latter theory. It has been found that platelets and fibrin (a protein, the final product in thrombosis) are often found in atherosclerotic plaques, also found are cholesterol crystals and cells which are rich in lipid.

The evidence suggests that thrombosis may play a role in atherosclerosis, and in the development of the more complicated atherosclerotic plaque. Though thrombosis may be important in initiating the plaque, an elevated blood lipid level may accelerate arterial narrowing. Plaque Inside the plaque is a yellow, porridge-like substance, consisting of blood lipids, cholesterol and triglycerides. These lipids are found in the bloodstream, they combine with specific proteins to form lipoproteins. All lipoprotein particles contain cholesterol, triglycerides, phospholipids, and proteins, but the proportion varies in different particles.

Lipoproteins Lipoproteins all vary in size. The largest lipoproteins are called Chylomicra, and consist mostly of triglycerides.

The next in size are the pre- beta-lipoproteins, then the beta lipoproteins. As their size decreases, so do their concentration of triglycerides, but the smaller they are, the more cholesterol they contain.

Pre-beta-lipoproteins are also known as low density lipoproteins (LDL), and beta lipoproteins are also called very low density lipoproteins (VLDL). They are most significant in the development of atheroma. The smallest lipoprotein particles, the alpha lipoproteins, contain a low concentration of cholesterol and triglycerides, but a high level of proteins, and are also known as high density lipoproteins (HDL). They are thought to be protective against the development of atherosclerotic plaque. In fact, they are transported to the liver rather than to the blood vessels.

**Lipoproteins and Atheroma** The theory is that lipoproteins pass between the lining cells of the arteries and some of them accumulate underneath. All except the chylomicra, which are too big, have a chance to accumulate. The protein in the lipoproteins are broken down by enzymes, leaving behind the cholesterol and triglycerides. These fats are trapped and set up a small inflammatory reaction. The alpha particles do not react with the enzymes are returned to the circulation.

## RISK FACTORS

There are several risk factors that contribute to the development of atherosclerosis and angina: Family history, Diabetes, Hypertension, Cholesterol, and Smoking.

**Family History** We all carry approximately 50 genes that affect the function and structure of the heart and blood vessels. Genetics can determine one's risk of having heart disease. There are many cases today where heart disease runs in a family, for many generations. **Diabetes** Diabetics are at least twice as likely to develop angina than nondiabetics, and the risk is higher in women than in men. Diabetes causes metabolic injury to the lining of arteries, as a result, the tiny blood vessels that nourish the walls of medium-size arteries throughout the body, including the coronary arteries, become defective. These microscopic vessels become blocked, impeding the delivery of blood to the lining of the larger arteries, causing them to deteriorate, and arteriosclerosis results.

**Hypertension** High blood pressure directly injures the artery lining by several mechanisms. The increased pressure compresses the tiny vessels that feed the artery wall, causing structural changes in these tiny arteries. Microscopic fracture lines then develop in the arterial wall.

The cells lining the arteries are compressed and injured, and can no longer act as an adequate barrier to cholesterol and other substances collecting in the inner walls of the blood vessels.

**Cholesterol** Cholesterol has become one of the most important issues in the last decade. Reducing cholesterol intake can directly decrease one's risk of developing heart disease, and people today are more conscious of what they eat, and how much cholesterol their foods contain. Cholesterol causes atherosclerosis by progressively narrowing the arteries and reduces blood flow. The building up of fatty deposits actually begins at an early age, and

the process progresses slowly. By the time the person reaches middle-age, a high cholesterol level can be expected.

Smoking It has been proven that about the only thing smoking do is shorten a person's life. Despite all the warnings by the surgeon general, people still manage to find an excuse to quit smoking. Cigarette smoke contains carbon monoxide, radioactive polonium, nicotine, arsenious oxide, benzopyrene, and levels of radon and molybdenum that are TWENTY times the allowable limit for ambient factory air.

The two agents that have the most significant effect on the cardiovascular system are carbon monoxide and nicotine. Nicotine has no direct effect on the heart or the blood vessels, but it stimulates the nerves on these structures to cause the secretion of adrenaline.

The increase of adrenaline and noradrenaline increases blood pressure and heart rate by about 10% for an hour per cigarette. In simpler words, nicotine causes the heart to beat more vigorously. Carbon monoxide, on the other hand, poisons the normal transport systems of cell membranes lining the coronary arteries. This protective lining breaks down, exposing the undersurface to the ravages of the passing blood, with all its clotting factors as well as cholesterol. Multiple Risk Factors The five major risk factors described above do more than just add to one another. There is a virtual multiplication effect in victims with more than one risk factor.

(Chart: Risk Factors)

## DIAGNOSIS

It is very important for patients to tell their doctors of the symptoms as honestly and accurately as possible. The doctor will need to know about other symptoms that may distinguish angina from other conditions, such as esophagitis, pleurisy, costochondritis, pericarditis, a broken rib, a pinched nerve, a ruptured aorta, a lung tumour, gallstones, ulcers, pancreatitis, a collapsed lung or just be nervous. Each of the above mentioned is capable of causing chest pain. A patient may take a physical examination, which includes taking the pulse and blood pressure, listening to the heart and lung with a stethoscope, and checking weight. Usually an experienced cardiologist can distinguish it as a cardiac or noncardiac situation within minutes.

There are also routine tests, such as urine and blood tests, which can be used to determine body fat level. Blood test can also tests for: Anemia - where the level of haemoglobin is too low, and can restrict the supply of blood to the heart. Kidney function - levels of various salts, and waste products, mainly urea and creatinine in the blood. Normally these levels should be quite low.

There are other factors which can be tested such as salt level, blood fat and sugar levels.

A chest x-ray provides the doctor with information about the size of the heart. Like any other muscles in the body, if the heart works too hard for a period of time, it develops, or enlarges. An electrocardiogram (ECG) is the tracing of the electrical activity of the heart. As the heart beats and relaxes, the signals of the heart's electrical activities are picked up and the pattern is

recorded. The pattern consists of a series of alternating plateaus and sharp peaks.

ECG can indicate if high blood pressure has produced any strain on the heart. It can tell if the heart is beating regularly or irregularly, fast or slow. It can also pick up unnoticed heart attacks. A variation of the ECG is the vectorcardiogram (VCG). It performs exactly like the ECG except the electrical activity is shown in the form of loops, or vectors, which can be watched on a screen, printed on paper, or photographed.

What makes VCG superior to ECG is that VCG provides a three-dimensional view of a single heart beat.

#### DRUG TREATMENT

Angina patients are usually prescribed at least one drug. Some of the drugs prescribed improve blood flow, while others reduce the strain on the heart. Commonly prescribed drugs are nitrates, beta-blockers, and Calcium antagonists. It should be noted that drugs for angina only relieve the pain, it does nothing to correct the underlying disorder. Nitrates Nitroglycerine, which is the basis of dynamite, relaxes the smooth fibres of the blood vessels, allowing the arteries to dilate.

They have a tendency to produce flushing and headaches because the arteries in the head and other parts of the body will also dilate. Glyceryl trinitrate is a short-acting drug in the form of small tablets. It is taken under the tongue for maximum and rapid absorption since that area is lined with capillaries. It usually relieves the pain within a minute or two. One of the

drawbacks of trinitrates is that they can be exposed too long as they deteriorate in sunlight.

Trinitrates also come in the form of ointment or “ transdermal” sticky patch which can be applied to the skin. Dinitrates and mononitrates are used for the prevention of angina attacks rather than as pain relievers.

They are slower acting than trinitrates, but they have a more prolonged effect. They have to be taken regularly, usually three to four times a day. Dinitrates are more common than trinitrates or tetranitrates.

Beta-blockers Beta-blockers are used to prevent angina attacks. They reduce the work of the heart by regulating the heart beat, as well as blood pressure; the amount of oxygen required is thereby reduced. These drugs can block the effects of the stress hormones adrenaline and noradrenaline at sites called beta receptors in the heart and blood vessels. These hormones increase both blood pressure and heart rate.

Other sites affected by these hormones are known as alpha receptors. There are side effects, however, for using beta-blockers. Further reduction in the pumping action may drive to a heart failure if the heart is strained by heart disease. Hands and feet get cold due to the constriction of peripheral vessels.

Beta-blockers can sometimes pass into the brain fluids, and causes vivid dreams, sleep disturbance, and depression. There is also a possibility of developing skin rashes and dry eyes.

Some beta-blockers raise the level of blood cholesterol and triglycerides.

Calcium antagonists These drugs help prevent angina by mopping up calcium in the artery walls.

The arteries then become relaxed and dilated, so reducing the resistance to blood flow, and the heart receives more blood and oxygen. They also help the heart muscle to use the oxygen and nutrients in the blood more efficiently. In larger dose they also help lower the blood pressure. The drawback for calcium antagonists is that they tend to cause dizziness and fluid retention, resulting in swollen ankles. Other Medications There are new drugs being developed constantly. Pexid, for example, is useful if other drugs fail in severe angina attacks.

However, it produces more side effects than others, such as pins and needles and numbness in limbs, muscle weakness, and liver damage. It may also precipitate diabetes, and damages to the retina. SURGERY When medications or any other means of treatment are unable to control the pain of angina attacks, surgery is considered. There are two types of surgical operation available: Coronary Bypass and Angioplasty. The bypass surgery is the more common, while angioplasty is relatively new and is also a minor operation.

Surgery is only a “ last resort” to provide relief and should not be viewed as a permanent cure for the underlying disease, which can only be controlled by changing one’s lifestyle. Coronary Bypass Surgery The bypass surgery involves extracting a vein from another part of the body, usually the leg, and uses it to construct a detour around the diseased coronary artery. This



procedure restores the blood flow to the heart muscle. Although this may sound risky, the death rate is actually below 3 per cent. This risk is higher, however, if the disease is widespread and if the heart muscle is already weakened. If the grafted artery becomes blocked, a heart attack may occur after the operation.

The number of bypasses depends on the number of coronary arteries affected. Coronary artery disease may affect one, two, or all three arteries. If more than one artery is affected, then several grafts will have to be carried out during the operation. About 20 per cent of the patients considered for surgery have only one diseased vessel. In 50 per cent of the patients, there are two affected arteries, and in 30 per cent the disease strikes all three arteries.

These patients are known to be suffering from triple vessel disease and require a triple-bypass.

Triple vessel disease and disease of the left main coronary artery before it divides into two branches are the most serious conditions. The operation itself incorporates making an incision down the length of the breastbone in order to expose the heart. The patient is connected to a heart- lung machine, which takes over the function of the heart and lungs during the operation and also keeps the patient alive. At the same time, a small incision is made on the leg to remove a section of the vein.

Once the section of vein has been removed, it is attached to the heart. One end of the vein is sewn to the aorta, while the other end is sewn into the affected coronary artery just beyond the diseased segment. The grafted vein

now becomes the new artery through which the blood can flow freely beyond the obstruction. The original artery is thus bypassed. The whole operation requires about four to five hours, and may be longer if there is more than one bypass involved.

After the operation, the patient is sent to the Intensive Care Unit (ICU) for recovery.

The angina pain is usually relieved or controlled, partially or completely, by the operation. However, the operation does not cure the underlying disease, so the effects may begin to diminish after a while, which may be anywhere from a few months to several years. The only way patients can avoid this from happening is to change their lifestyles. Angioplasty This operation is a relatively new procedure, and it is known in full as transluminal balloon coronary angioplasty.

It entails “squashing” the atherosclerotic plaque with balloons. A very thin balloon catheter is inserted into the artery in the arm or the leg of a patient under general anaesthetic. The balloon catheter is guided under x-ray just beyond the narrowed coronary artery. Once there, the balloon is inflated with fluid and the fatty deposits are squashed against the artery walls.

The balloon is then deflated and drawn out of the body. This technique is a much simpler and more economical alternative to the bypass surgery. The procedure itself requires less time and the patient only remains in the hospital for a few days afterward. Exactly how long the operation takes depends on where and in how many places the artery is narrowed. It is most suitable when the disease is limited to the left anterior descending artery,

but sometimes the plaques are simply too hard, making them impossible to be squashed, in which case a bypass might be necessary. SELF-HELP The only way patients can prevent the condition of their heart from deteriorating any further is to change their lifestyles.

Although drugs and surgery exist, if the heart is exposed to pressure continuously and it strains any further, there will come one day when nothing works, and all that remain is a one-way ticket to heaven. The following are some advices on how people can change the way they live, and enjoy a lifetime with a healthy heart once more. Work A person should limit the amount of exertions to the point where angina might occur. This varies from person to person, some people can do just as much work as they did before developing angina, but only at a slower pace. Try to delegate more, reassess your priorities, and learn to pace yourself.

If the rate of work is uncontrollable, think about changing the job.