



Angina pectoris- a comprehensive review of clinical features, differential diagnosis, and remedies

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ABSTRACT

Angina pectoris is the medical term for chest pain or discomfort due to coronary heart disease. Angina is a symptom of a condition called myocardial ischemia. It occurs when the heart muscle (myocardium) doesn't get as much blood (hence as much oxygen) as it needs. This usually happens because one or more of the heart's arteries (coronary blood vessels that supply blood to the heart muscle) is narrowed or blocked. Insufficient blood supply is called ischemia. Major risk factors for angina include cigarette smoking, diabetes, high cholesterol, high blood pressure, sedentary lifestyle and family history of premature heart disease. . This causes the distal part of the heart does not receive any more blood and individuals will develop chest pain. Initially when the coronary disease is mild the angina will occur during exercise, eating heavy meals, extreme heat or stress. As the coronary disease worsens, the angina will come on with minimal work and may even occur at rest. The first approach in the treatment of angina pectoris is to prevent the progression of heart disease. By addressing the known causes of heart disease, such as reducing high cholesterol levels, controlling high blood pressure, stopping smoking, losing weight, exercising and eating a "heart-healthy" diet, the symptoms can be reduced. Most people can live a productive life if they make the necessary lifestyle changes. By following medical advice, taking doctor-prescribed medication, maintaining a good, physical condition and eating well, angina can be controlled. There are also natural alternatives to conventional medicine such as herbal and homeopathic remedies useful in controlling angina without the harsh side effects associated with prescription drugs. Herbal and homeopathic remedies are safe and gentle to use, while at the same time addressing the underlying causes of the condition.

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Introduction

Angina pectoris is a medical condition that occurs when your heart receives a decreased amount of oxygenated blood. Often, this occurs due to deposits of cholesterol clogging the blood vessels that carry blood to your heart. Patients who have angina pectoris are at an risk for having a heart attack, Chest pain behind the breastbone is the most common sign of angina pectoris. The discomfort may feel like pressure, squeezing, burning or tightness, reports the National Heart Lung and Blood Institute. The chest pain is most common during exercise, physical work or sexual activity. Emotional stress, cold weather and nightmares may also trigger an attack of chest pain, explains Cedars-Sinai Medical Center. Patients with severe angina pectoris may also develop the pain during rest without the presence of any stress. An episode of chest pain caused by angina pectoris may last from 5 to 30 minutes, Angina is a common presenting symptom (typically, chest pain) among patients with coronary artery disease. Statistics reveal that close to 7 million American suffer from angina and countless more do not even know if they have it. Each year close to half a million new cases are diagnosed. The common condition affects nearly ¼ individuals over the age of 55. Each year, there are more than 1 million cases of recurrent acute angina, with a mortality rate of close to 40%. In addition, there are a significant number of

individual who die suddenly and have no symptoms. No race or ethnic groups are immune from coronary artery disease. angina pectoris is far more common in women than men. In addition, angina in women can present in an atypical fashion. The pain may not be in the chest area and the pain may have a different quality. To improve the prognosis, it is essential that one change the lifestyle. One should adhere to these changes, otherwise angina will recur. The best preventive measures one can take include - start an exercise program - stop smoking - decrease alcohol consumption - avoid stressful situation - avoid heavy and fatty meals. The best treatment of angina is drug therapy. The most common group of drugs used to treat angina is nitroglycerines. Nitroglycerin is available in various formulations. It can be taken by mouth, placed underneath the tongue and can even be given intravenously. Nitroglycerin has the ability to open up (dilate) blood vessel and allows more blood to the heart. Nitroglycerin is usually taken when one feels the chest pain coming. A tablet is placed underneath the tongue and within a few minutes the pain will disappear. In some cases, two tablets may be required. Nitroglycerin formulations are also available as an oral pill which must be taken 2-3 times a day. Beta blockers have been used to treat coronary disease for decades. They act by decreasing the work of the heart and thus decrease oxygen utilization. Unfortunately they work in the long

term and do not work immediately, like nitroglycerin. Beta blockers have to be taken every day and have a few side effects like a decrease in libido. Calcium channel blockers are very effective in the treatment of angina, but like the beta blockers they have to be taken daily.

Causes angina pectoris

In most cases, the cause of angina is coronary atherosclerosis: the thickening of arteries that supply blood, oxygen and nutrients to the heart. This happens when fatty deposits, called plaques or atheroma, narrow the arteries over time and reduce blood flow to the heart. Symptoms may only appear at times when your heart needs more blood supply, such as when you're stressed, exercising or climbing stairs. As your heart tries to pump faster to meet your body's increased demands, the narrowed arteries struggle to keep up. The heart then receives too little oxygen, which causes pain in the heart that is felt as chest pain. In severe cases this can also happen when the heart is at rest.

Types of angina pectoris

Angina is classified as one of the following two types:

- Stable angina
- Unstable angina

Stable Angina

Stable angina is the most common angina, and the type most people mean when they refer to angina. People with stable angina usually have angina symptoms on a regular basis. The episodes occur in a pattern and are predictable. For most people, angina symptoms occur after short bursts of exertion. Stable angina symptoms usually last less than five minutes. They are usually relieved by rest or medication, such as nitroglycerin under the tongue.

Unstable Angina

Unstable angina is less common. Angina symptoms are unpredictable and often occur at rest. This may indicate a worsening of stable angina, but sometimes the first time a person has angina it is already unstable. The symptoms are worse in unstable angina - the pains are more frequent, more severe, last longer, occur at rest, and are not relieved by nitroglycerin under the tongue.

Unstable angina is not the same as a heart attack, but it warrants an immediate visit to the healthcare provider or a hospital emergency department. The patient may need to be hospitalized to prevent a heart attack. If the patient has stable angina, any of the following may indicate worsening of the condition: An angina episode that is different from the regular pattern Being awakened at night by angina symptoms More severe symptoms than usual Having angina symptoms more often than usual Angina symptoms lasting longer than usual.

Coronary Heart Disease

The most common cause for the heart not getting enough blood is coronary heart disease, also called coronary artery disease. In this disease, the coronary arteries become blocked, narrowed, or otherwise damaged.

They can no longer supply the heart with all of the blood it needs. Most cases of coronary heart disease are caused by atherosclerosis (hardening of the arteries). Atherosclerosis is a condition in which a fatty substance/cholesterol builds up inside the blood vessels. These buildups are called plaques, and they can block blood flow through the vessels partially or completely. Multiple risk factors, particularly: diabetes, high blood pressure, smoking, high cholesterol, and genetic predisposition may accelerate this build up.

Coronary Artery Spasm

Another cause of unstable angina is coronary artery spasm. Spasm of the muscles surrounding the coronary arteries causes them to narrow or close off temporarily. This blocks the flow of blood to the heart muscle for a brief time, causing angina symptoms. This is called variant angina or Prinzmetal angina. This is not the same as atherosclerosis, although some people have both conditions. The symptoms often come on at rest (or during sleep) and without apparent cause. Cocaine use/abuse can cause significant spasm of the coronary arteries and lead to a heart attack.

Risk factors

All of us have fatty deposits in our arteries to some degree. Atherosclerosis can start as early as our 20s and increases with age. But there are risk factors that are known to increase the development of fatty deposits that can cause your arteries to narrow.

- A family history of atherosclerosis.
- High levels of LDL cholesterol in the blood.
- High blood pressure.
- Smoking.
- Being male.
- Diabetes.
- Obesity.
- Stress.
- Lack of regular exercise.

Symptoms of angina pectoris

Symptoms typically start during physical exertion or emotional stress. They are often worse in cold or windy weather and sometimes after big meals.

- A squeezing or heavy pressing sensation on the chest.
- Increased shortness of breath on exercise.
- A sense of heaviness or numbness in the arm, shoulder, elbow or hand, usually on the left side.
- A constricting sensation in the throat.
- The discomfort can radiate into arms, the jaw, teeth, ears, stomach and in rare cases between the shoulder blades.

Unstable angina is associated with the same symptoms at rest. In some cases the fatty deposits that restrict blood flow can rupture. Blood then clots around the rupture, and the clot may be large enough to block the artery and seal off the blood supply. This may cause unstable angina or a heart attack.

Pathophysiology

Myocardial ischemia develops when coronary blood flow becomes inadequate to meet myocardial oxygen demand. This causes myocardial cells to switch from aerobic to anaerobic metabolism, with a progressive impairment of metabolic, mechanical, and electrical functions. Angina pectoris is the most common clinical manifestation of myocardial ischemia. It is caused by chemical and mechanical stimulation of sensory afferent nerve endings in the coronary vessels and myocardium. These nerve fibers extend from the first to fourth thoracic spinal nerves, ascending via the spinal cord to the thalamus, and from there to the cerebral cortex. Studies have shown that adenosine may be the main chemical mediator of anginal pain. During ischemia, ATP is degraded to adenosine, which, after diffusion to the extracellular space, causes arteriolar dilation and anginal pain. Adenosine induces angina mainly by stimulating the A1 receptors in cardiac afferent nerve endings. Heart rate, myocardial inotropic state, and myocardial wall tension are the major determinants of myocardial metabolic activity and myocardial oxygen demand. Increases in the heart rate and

myocardial contractile state result in increased myocardial oxygen demand. Increases in both after load (ie, aortic pressure) and preload (ie, ventricular end-diastolic volume) result in a proportional elevation of myocardial wall tension and, therefore, increased myocardial oxygen demand. Oxygen supply to any organ system is determined by blood flow and oxygen extraction. Because the resting coronary venous oxygen saturation is already at a relatively low level (approximately 30%), the myocardium has a limited ability to increase its oxygen extraction during episodes of increased demand. Thus, an increase in myocardial oxygen demand (eg, during exercise) must be met by a proportional increase in coronary blood flow. The ability of the coronary arteries to increase blood flow in response to increased cardiac metabolic demand is referred to as coronary flow reserve (CFR). In healthy people, the maximal coronary blood flow after full dilation of the coronary arteries is roughly 4-6 times the resting coronary blood flow. CFR depends on at least 3 factors: large and small coronary artery resistance, extravascular (ie, myocardial and interstitial) resistance, and blood composition. Myocardial ischemia can result from (1) a reduction of coronary blood flow caused by fixed and/or dynamic epicardial coronary artery (ie, conductive vessel) stenosis, (2) abnormal constriction or deficient relaxation of coronary microcirculation (ie, resistance vessels), or (3) reduced oxygen-carrying capacity of the blood. Atherosclerosis is the most common cause of epicardial coronary artery stenosis and, hence, angina pectoris. Patients with a fixed coronary atherosclerotic lesion of at least 50% show myocardial ischemia during increased myocardial metabolic demand as the result of a significant reduction in CFR. These patients are not able to increase their coronary blood flow during stress to match the increased myocardial metabolic demand, thus they experience angina. Fixed atherosclerotic lesions of at least 90% almost completely abolish the flow reserve; patients with these lesions may experience angina at rest. Coronary spasm can also reduce CFR significantly by causing dynamic stenosis of coronary arteries. Prinzmetal angina is defined as resting angina associated with ST-segment elevation caused by focal coronary artery spasm. Although most patients with Prinzmetal angina have underlying fixed coronary lesions, some have angiographically normal coronary arteries. Several mechanisms have been proposed for Prinzmetal angina: focal deficiency of nitric oxide production, hyperinsulinemia, low intracellular magnesium levels, smoking cigarettes, and using cocaine. Approximately 30% of patients with chest pain referred for cardiac catheterization have normal or minimal atherosclerosis of coronary arteries. A subset of these patients demonstrates reduced CFR that is believed to be caused by functional and structural alterations of small coronary arteries and arterioles (ie, resistance vessels). Under normal conditions, resistance vessels are responsible for as much as 95% of coronary artery resistance, with the remaining 5% being from epicardial coronary arteries (ie, conductive vessels). The former is not visualized during regular coronary catheterization. Angina due to dysfunction of small coronary arteries and arterioles is called microvascular angina. Several diseases, such as diabetes mellitus, hypertension, and systemic collagen vascular diseases (eg, systemic lupus erythematosus, polyarteritis nodosa), are believed to cause microvascular abnormalities with subsequent reduction in CFR. The syndrome that includes angina pectoris, ischemia like ST-segment changes and/or myocardial perfusion defects during stress testing, and angiographically normal coronary arteries is referred to as syndrome X. Most patients

with this syndrome are postmenopausal women, and they usually have an excellent prognosis. Syndrome X is believed to be caused by microvascular angina. Multiple mechanisms may be responsible for this syndrome, including (1) impaired endothelial dysfunction (2) increased release of local vasoconstrictors, (3) fibrosis and medial hypertrophy of the microcirculation, (4) abnormal cardiac adrenergic nerve function, and/or (5) estrogen deficiency. A number of extravascular forces produced by contraction of adjacent myocardium and intraventricular pressures can influence coronary microcirculation resistance and thus reduce CFR. Extravascular compressive forces are highest in the subendocardium and decrease toward the subepicardium. Left ventricular (LV) hypertrophy together with a higher myocardial oxygen demand (eg, during tachycardia) cause greater susceptibility to ischemia in subendocardial layers. Myocardial ischemia can also be the result of factors affecting blood composition, such as reduced oxygen-carrying capacity of blood, as is observed with severe anemia (hemoglobin, <8 g/dL), or elevated levels of carboxyhemoglobin. The latter may be the result of inhalation of carbon monoxide in a closed area or of long-term smoking. Ambulatory ECG monitoring has shown that silent ischemia is a common phenomenon among patients with established coronary artery disease. In one study, as many as 75% of episodes of ischemia (defined as transient ST depression of >1 mm persisting for at least 1 min) occurring in patients with stable angina were clinically silent. Silent ischemia occurs most frequently in early morning hours and may result in transient myocardial contractile dysfunction (ie, stunning). The exact mechanism(s) for silent ischemia is not known. However, autonomic dysfunction (especially in patients with diabetes), a higher pain threshold in some individuals, and the production of excessive quantities of endorphins are among the more popular hypotheses.

Exams and tests

Upon hearing about the patient's symptoms, the primary healthcare provider or the provider in the emergency department will immediately think of angina and other heart problems. Time is of the essence - treatment will probably begin as the evaluation continues. An electrocardiogram (ECG) will be done. This painless test checks for abnormalities in the beating of the heart. Electrodes are attached to the chest and other points on the body. The electrodes read the electrical impulses linked to the beating of the heart. The ECG looks for signs of a heart attack or of impaired blood flow to the heart. For many patients with angina, the ECG result is normal. The patient may have a chest x-ray. This will show any fluid buildup in the lungs. It can also rule out some other causes of chest pain. There is no blood lab test that can tell with certainty that someone is having angina. There are certain blood tests that suggest that a person may be having a heart attack. These tests may be done if a heart attack is suspected. While these tests are going on, the healthcare provider will be asking questions to help with the diagnosis. The questions will be about the symptoms and about the patient's medical history: previous operations, medications, allergies, and habits and lifestyle. The physical exam will include listening to the heart and lungs and feeling the heart through the chest. If, after these tests, the healthcare provider suspects the patient may have coronary heart disease, additional tests will be performed to confirm the possibility.

Exercise stress test: An ECG is taken before, during, and after exercise (usually walking on a treadmill) to detect inadequate

blood flow to the heart muscle indirectly by changes on the ECG. This usually is done only for stable angina.

Thallium stress test: This is a more complex and expensive test that injects a radioisotope into the circulation and indirectly detects parts of the heart that may not be getting enough blood during "stress" (usually walking on a treadmill, or after administration of a drug that mimics exercise in those unable to walk on the treadmill). This information indicates more accurately whether any of the coronary arteries may be narrowed, causing inadequate blood flow to the heart muscle or ventricle. Again, this is usually done only for stable angina.

Dobutamine echocardiogram stress test: This is done for people who cannot walk on a treadmill. A drug called dobutamine stimulates and speeds up the heart, creating an increased demand or need for blood flow to the left ventricle or muscle. If the muscle shows a slowing of function on the ultrasound image of the heart muscle, then it indirectly indicates inadequate blood flow to the muscle.

Coronary angiogram (or arteriogram): This test of the coronary arteries is the most accurate but also the most invasive. It is a type of x-ray. A thin, plastic tube called a catheter is threaded through an artery in the arm or groin to one of the main coronary arteries. A contrast, or harmless dye is injected into the arteries. The dye depicts the arteries directly and shows any blockage more accurately than the above or more noninvasive procedures.

The healthcare provider will make the decision about whether these tests or any treatment need to be done on an urgent basis. If so, the patient will be admitted to the hospital. If not, the tests will be scheduled for the next few days, and the patient may be allowed to go home.

Treatment of angina pectoris

You may need to take several medicines to control symptoms and improve your angina.

- Aspirin in low doses reduces the tendency of small blood cells called platelets to stick together, which helps prevent the formation of a blood clots.
- Glyceryl trinitrate relaxes the arteries of the heart and relieves angina attacks. GTN comes in sublingual tablet or spray form.
- Long-acting nitrates reduce the frequency of angina attacks. These can be in the form of tablets or patches and are very effective. Their main side-effect is headache, but this often disappears once the nitrate has been taken for some weeks.
- Beta-blockers block the effect of the hormone adrenaline so that the pulse is slowed and blood pressure lowered. This reduces the heart's need for oxygen and improves the supply of blood to the heart muscle. They are also important in protecting the heart after heart attacks.
- Calcium-channel blockers reduce the muscle tension in the coronary arteries, expanding them and creating more room. They also slightly relax the heart muscle, reducing the heart's need for oxygen and reducing blood pressure.
- The potassium-channel activator nicorandil (Ikorel) reduces muscle tension in the blood vessel walls, expanding them and improving the flow of blood and the supply of oxygen.

Surgery

If you have severe angina that is not responding to medication, a cardiologist may decide you need surgery to restore heart function to an adequate level and reduce the likelihood of a heart attack.

This can be done by one of the following operations.

- **Angioplasty:** the narrowed coronary artery is dilated (opened up) with a balloon. A small tube called a stent may also be

inserted into the artery at this time to help prevent it narrowing down again in the future.

- **Bypass operation:** a superficial blood vessel is taken from another part of your body, usually the leg, and joined to the coronary artery to bypass the obstruction to blood flow.

Transmyocardial Revascularization

Transmyocardial revascularization is a procedure for people who cannot undergo angioplasty or surgery. A simple incision is made in the chest, and a laser is used to "drill" small holes through the outside wall of the heart into the left ventricle. About 20-40 holes are made. Bleeding from these holes is minimal and usually stops after a few minutes of pressure. It is not clear why this helps relieve angina. One theory is that it stimulates growth of new blood vessels that improve blood flow to the heart. Other investigators believe it is a placebo effect. Current research is focusing on trying to find growth factors that could be injected into coronary arteries or directly into the left ventricle to encourage growth of new blood vessels.

Diet for preventing angina pectoris

Obviously, a healthy diet goes a long way in preventing angina pectoris. The following basic guidelines need to be followed with meticulous care:- Avoid fatty foods to the maximum possible extent. This includes fried food, milk products such as butter and cheese, full cream milk, oils, etc. Fermented milk products are good for people with angina. This includes curds. Use only vegetable oils for cooking. This includes sunflower, olive, groundnut and rapeseed oils. Avoid salt in the diet. Do not consume foods that are too much salty. In meats, red meats such as mutton, beef and pork must be avoided. White meats such as poultry and fish are beneficial. Fishes with high body oil content must be preferred. This includes sardines, tunas, mackerels, salmons, herrings, etc. Canned fish must be strictly avoided. There should be at least two to three fish consumptions per week. Carbohydrates should form the major part of the food. This includes cereals, wheat, rice, bread, potatoes and pasta. It is found that a little bit of alcohol is actually beneficial for angina, but excess is harmful. The safe limit of alcohol is as follows:- For men: 21 units per week, and not more than 4 units on any one day. For women: 14 units per week, and not more than 3 units on any one day.

Prevention of angina pectoris

Many of the risk factors for angina can be tackled by lifestyle changes.

- Eat a varied and healthy diet with plenty of leafy vegetables. Avoid sugary foods and saturated fats found in meat and full-fat dairy products.
- Stop smoking. Your doctor or pharmacist will be able to provide advice about stop-smoking programmes and medicines that can help you quit.
- Lose weight if you are overweight.
- Exercise more: aim for a half-hour walk each day.
- If you have diabetes or high blood pressure, maintain treatment for these conditions.

Ayurvedic herbs

Ayurveda is a treasure-house of remedies for angina pectoris. There is a long list of herbs that have been used since ancient times for the treatment of the condition. The following is a list of these herbs with their actions on the human body:- Guggul is an age-old remedy used by Ayurvedic exponents for treating angina pectoris and its complications. Guggul is in fact a mixture of several substances that have been extracted from the *Commiphora mukul* plant. This medicine is effective in treating atherosclerosis, which is a leading cause of angina. This is

because of guggulsterone, which is a compound found in the guggul plant.

Conclusion

Angina Pectoris is a term for chest pain caused by an inadequate supply of blood and oxygen to the heart. More than 9 million people in the United States have angina. With angina, the affected patient's heart may get sufficient blood for daily activities, but the arteries may not be able to respond appropriately to increased demands for oxygen during exercise, times of emotional or physical stress, and with extremes of temperature. Treatments for angina depend on the type and severity of the angina. For most people with stable angina, symptoms disappear after a period of time. Rest and nitroglycerin may be sufficient to treat the attack. For people with unstable angina, other medications such as antiplatelet medications, beta blockers, calcium channel blockers and blood thinners may be given. In severe cases of angina, or where the risk of a heart attack is high, surgical procedures such as a coronary artery bypass grafting and percutaneous transluminal angioplasty may be recommended.

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Ayurvedic Name of the Herb	Biological Name of the Herb	Common English Name of the Herb	Action on the Human Body
Alfalfa	Medicago sativa	Alfalfa	Juice of the alfalfa grass is used for people with arterial and heart problems. The benefits of this juice are improved by taking it in a mixture with carrot juice.
Amla	Emblica officinalis	Indian Gooseberry	Amla tones up all the organs of the body, and that includes the heart. Thus it betters the pumping action of the heart.
Chachinga	Trichosanthes anguina	Snake Gourd	The leaves of the snake gourd have been traditionally used as medicine for treating pain in the heart due to physical exertion.
Haldi	Curcuma longa	Turmeric	Curcumin is a chemical compound present in turmeric. This compound is known to lower the amount of serum cholesterol and even the blood sugar level.
Kahu	Terminalia arjuna	Arjuna	Arjuna is perhaps the most beneficial herb used by Ayurvedic practitioners in the treatment of angina-related problems. The bark of the arjuna tree is known to have stimulant action on the heart.
Lahsoona	Allium sativa	Garlic	Garlic is beneficial for people with angina pectoris as it is a known blood thinner. For this reason, garlic must be included in the diet.
Peepal	Ficus religiosa	Peepal	The leaves of the peepal tree are effective in treatment of heart ailments. They are known to strengthen the heart and thus keep angina pectoris at bay.
Pyaza	Allium cepa	Onion	Trials have shown that regular usage of onion for five months is beneficial in decreasing serum cholesterol. It is also beneficial in decreasing thrombosis.
Rojmari	Achillea millefolium	Blood Wort	The herb of blood wort is beneficial in the treatment of circulatory problems due to its stimulant action. It can bring down high blood pressure, which is a leading cause of angina pectoris.
Tilpushpi	Digitalis purpurea	Digitalis	Treatment of angina pectoris is one of the most elemental purposes digitalis is put to. Digitalis stimulates the muscle activity of the heart and makes it pump better. Thus it forces more blood into the heart and improves nourishment.