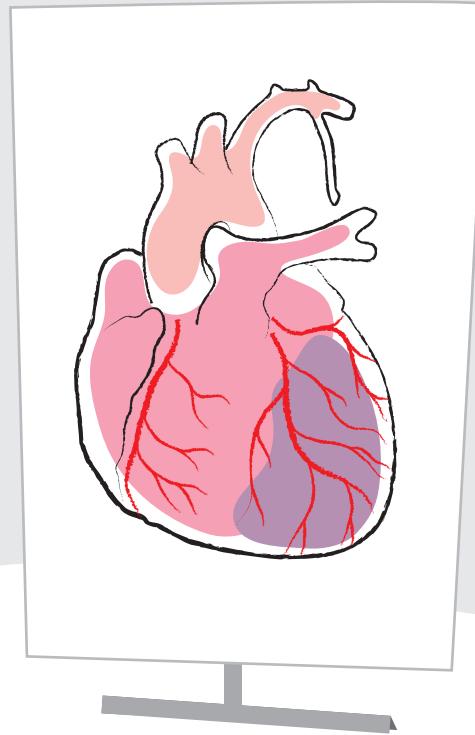




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WHAT YOU SHOULD KNOW ABOUT ANGINA

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It is not a textbook for diagnostic or treatment purposes



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What is angina?

Angina is a heart disease associated with chest pain or discomfort that happens when the heart muscle does not receive enough blood rich in oxygen through the coronary arteries. The heart is a muscular organ that pumps blood through the vascular system supplying oxygen, glucose and other nutrients to the brain, lungs, kidneys and other organs and parts of the body, thus ensuring their proper function. Like other organs, the heart also requires blood to make about 250,000 beats daily. The blood enters the heart through two main arteries, called the coronary arteries: the right coronary artery and the left coronary artery.

Angina is a very common disease. According to statistics, over 3.2 million people in Ukraine suffer from angina.

*There are three different types of angina: **stable angina**, **unstable angina** and **variant angina** (Prinzmetal angina). Knowing the difference between these types is very important, as they have different symptoms and risk profiles and require different treatment.*

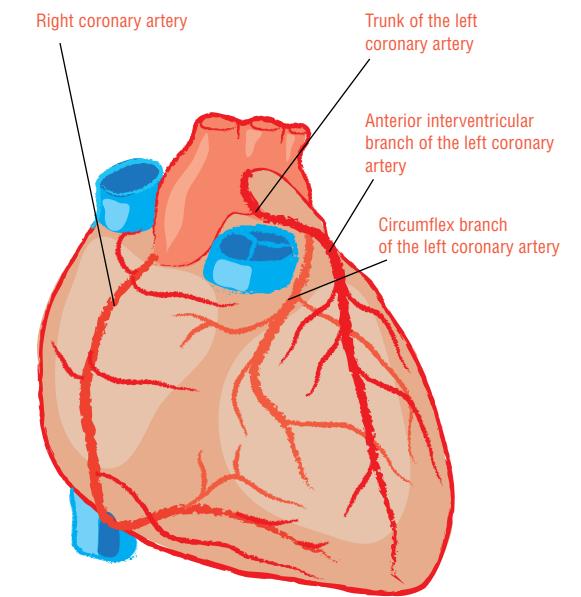
STABLE ANGINA is the most common type that is normally characterized by symptoms occurring during physical exercise: running, climbing stairs, walking, lifting a weight. In these cases, the heart has to work harder to supply more blood, and thus more oxygen, to upper and lower extremities during the exercise. The narrowing of coronary vessels in this disease causes imbalance between increased oxygen demand of the heart and insufficient blood supply. The pain usually lasts for a few minutes and goes away after rest. However, it may come back when you resume the exercise. It is very important that such pain attacks are absolutely identical, i.e. stereotypic. Normally, this type of angina is well controlled with medicines.

The severance of stable angina is defined according to the Canadian Cardiovascular Society grading (abridged):

- Functional class I. Regular physical activity does not cause angina attacks. The pain occurs only with excessive or prolonged unusual exertion;
- Functional class II. Slight limitation of regular physical activity. The pain occurs on walking more than two hundred meters on the level or climbing more than one flight of stairs;
- Functional class III. Marked limitation of regular physical activity. Angina attacks occur on walking one to two hundred meters on the level, or climbing one flight of stairs;
- Functional class IV. Any physical activity can cause an angina attack. The pain behind the breastbone may occur at rest.

UNSTABLE ANGINA is less common but more dangerous than stable angina. It may develop as a separate disease or as a result of stable angina progression. The symptoms of unstable angina may occur after slight exercise (e.g., after walking just a few steps) or even when you are resting. Furthermore, angina is considered unstable when the symptoms appear during usual physical exercise which used not to be accompanied by these symptoms before, for example, when your angina attack normally starts after climbing two floors of stairs, but you suddenly feel chest pain already after reaching the first floor. This should be regarded as a sign of destabilization, in which case you should seek medical advice. This usually happens when one of the blood vessels has become so narrow that the blood supply of the heart muscle is critically low and you are at immediate risk of myocardial infarction. Therefore, if you feel a sudden chest pain at rest lasting for more than 15 minutes, you should call an ambulance.

VARIANT ANGINA (Prinzmetal angina) is a very rare type of angina. It usually comes on suddenly when you are at rest, at night or in pre-dawn hours, while you are sleeping. This is caused by spontaneous spasm of coronary arteries. You may need additional tests to diagnose this type of angina.



What are the symptoms of angina?

An attack of angina usually starts with pain or feeling of tightness behind the breastbone on physical exertion. You may also feel heaviness or tension in your chest. The pain does not depend on moving or pressing on the chest with your hand or fingers, and it usually won't change if you take a deep breath. You may also feel pain in your shoulders, arms (especially the left arm), neck, jaw or back, or experience indigestion. The pain may come on when you are walking after a meal. Anger and stress may also lead to an attack or worsen your angina. The manifestations of angina may be aggravated by low temperatures; chest pain after moving from warm to cold environment indicates the presence of angina. The symptoms usually last for a few seconds or minutes but not longer than 15 minutes in total and are relieved after rest (stable angina). If symptoms last for more than 15 minutes, this is more likely to be an onset of unstable angina, especially when the pain is accompanied by other symptoms: sweating, weakness, severe shortness of breath, nausea or vomiting.

It is important to know that there are conditions other than angina or heart disease which can cause chest pain. Therefore, if you experience symptoms similar to the above or other symptoms in the heart area, you should tell your doctor about this.



What causes angina?

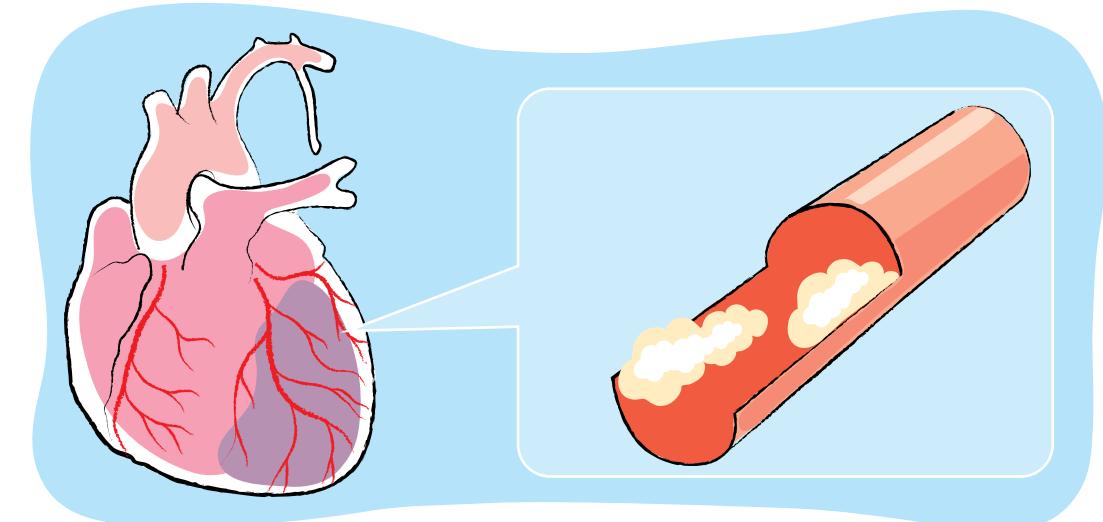
Angina as an attack of pain behind the breastbone is a symptom of an underlying heart condition, coronary heart disease (CHD), which is the most prevalent heart disease in Ukraine. A total of about 8.6 million patients suffer from CHD, of which, as we mentioned before, 3.2 million are patients with angina. CHD occurs when fat plaques build up on the inner walls of coronary arteries supplying the oxygen-rich blood to the heart. This process is called atherosclerosis, and its development causes the coronary arteries, as well as the other arteries of human body (such as the carotid artery carrying blood to the brain), to become narrow and rigid, reducing the flow of oxygen-rich blood to the heart muscle. Due to atherosclerotic narrowing of a coronary artery, the heart muscle (myocardium) area supplied with blood by the respective artery does not receive the sufficient amount of oxygen to meet the increased oxygen demand, which causes pain (angina). The plaques start to build up in coronary arteries from the age of 20. Their growth rate is partially determined by genetic factors but mostly by the presence of several risk factors, such as smoking, high blood pressure, diabetes and high blood levels of cholesterol and lipids (fats). Despite progressive narrowing of coronary arteries due to plaque accumulation, the patient may live

without manifestations of angina for years. However, when the reduction in blood supply reaches a certain level, an attack of angina occurs. At first, it may occur only after intense physical exercise, but later may develop after slight exercise or even when you are at rest.

The myocardial infarction (as a terminal stage of unstable angina) is a result of complete or almost complete blockage of the coronary artery and causes death of a portion of heart muscle cells (cardiomyocytes) leading to serious complications or death. The blockage may result from the continuous growth of the plaque or, more likely, its break-off which leads to the formation of a clot that narrows the vessel lumen and blocks blood flow. Therefore, angina should be regarded as a warning sign indicating the risk of myocardial infarction.

Like atherosclerosis, some other conditions can also lead to angina. They include:

- heart valve disease
- anemia (reduction in red blood cell count)
- fast irregular heart rhythm
- heart muscle disease
- coronary artery spasm or contraction



What are the risk factors for angina?

As coronary heart disease (CHD) is the main cause of angina, the major risk factors for angina are the same as for CHD. The incidence of coronary heart disease is higher for men aged from 45 to 55 than for women of the same age group, while after 55 the risk becomes equal. The probability of developing angina increases with age. The known non-modifiable risk factors include older age, male sex and family history (close relatives suffering from CHD after 45 years of age for men and 55 years of age for women). In other words, an elderly person whose relatives had a heart attack after 45 years of age has a higher risk of developing CHD symptoms (such as angina) or, even worse, a myocardial infarction, and nothing can be changed about this. However, we do have to manage the so-called modifiable risk factors of CHD. They include, primarily, smoking, excess weight, lack of physical activity, high blood pressure and high blood cholesterol level. This would mean appropriate modification of lifestyle and taking prescribed medications to prevent the onset of clinical manifestation of CHD (primary prevention) or any new and more dangerous clinical manifestations (secondary prevention).

Thus, you are at a higher risk of CHD if you:

- have high blood pressure;
- have high blood cholesterol level;
- smoke;
- are overweight;
- have diabetes;
- lack physical activity.

It is important to understand that simultaneous presence of the above risk factors poses a much higher risk of CHD than the simple total of these risk factors taken separately. In other words, if you smoke or suffer from diabetes, the risk of CHD in the next five years is 10% or 20% respectively, but this risk increases to 40–50% when both factors are present simultaneously.

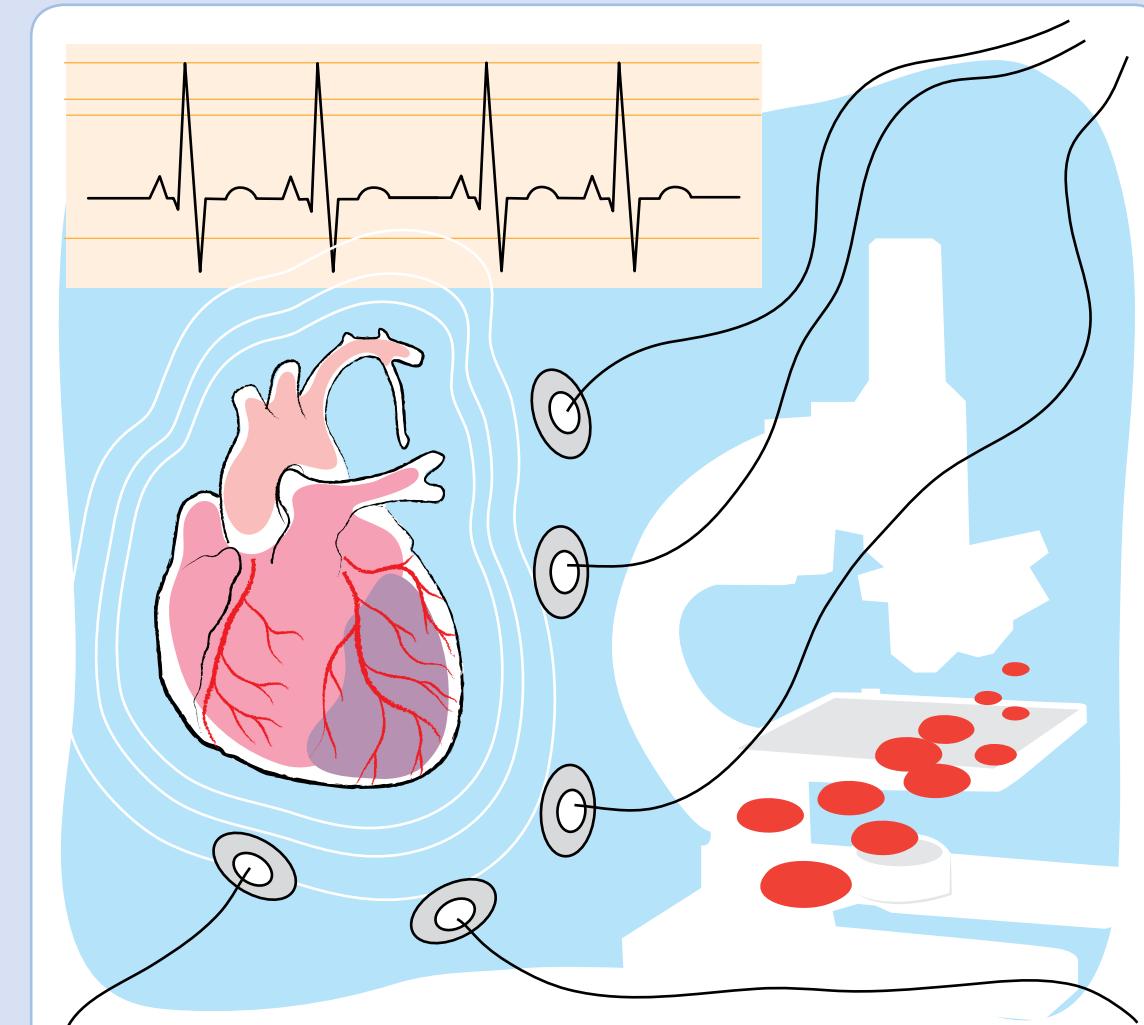


What should you do if you have symptoms of angina?

If you experience pain behind the breastbone with the above characteristics, you should consult your doctor to establish the diagnosis of angina. In fact, there are many conditions with similar symptoms, including gastritis, pericarditis, acid reflux disease, lung diseases, anxiety and many others. Therefore, all of the above conditions need to be excluded; the diagnosis can be established only by your physician or cardiologist, who will consider your general health status and risk factor profile. You will probably need some tests to find out whether you have any heart problems.

They may include the following **non-invasive** and **invasive** tests:

- **Electrocardiogram (ECG)** which measures the electrical activity of your heart and may show the signs of ischemia (oxygen starvation).
- **Blood tests**, such as tests for blood levels of cholesterol, lipids and cardiac enzymes (released by damaged heart cells).
- **Echocardiography (EchoCG)**, an ultrasound diagnostic technique which can show the work of heart valves and chambers and detect new abnormalities.
- **Treadmill or bicycle exercise test** where an ECG can record any provoked abnormalities.
- **Stress tests and nuclear scintigraphy**, the second stage of non-invasive testing performed when the symptoms indicate a coronary artery disease but the previous non-invasive tests failed to provide reliable results.
- **Coronary angiography**, an invasive (interventional) test where a dye is injected in the coronary artery and X-ray images can show whether your artery is narrowed or blocked. This test is conducted at the end of the diagnostic road map and, despite some risks associated with its invasive nature, it can help establish the final diagnosis and can also be used to treat coronary artery narrowing or blockage.



What should you do if you have an angina attack?

If you have an angina attack, you should stop any physical activity immediately. Some people tend to tolerate pain and continue their activity. This is dangerous. You should sit or lie down. If the pain persists, take nitroglycerin. There are some rules for taking the medicine. As mentioned above, nitroglycerin is available in various forms. For immediate relief, you should use simple nitroglycerin. One tablet contains 0.0005 g (0.5 mg) of nitroglycerin. Capsules containing 0.5 to 1 mg nitroglycerin and a 0.4 mg fixed-dose spray for sublingual use (to be sprayed under the tongue) are also available. Nitroglycerin acts by dilating vessels not only in the heart but in the whole body, which may cause a rapid blood pressure drop. In this case, you may feel sudden weakness and dizziness. That is why, nitroglycerin should be taken while sitting or lying down. Put the tablet under your tongue for 40 to 60 seconds until dissolved completely.

The initial dose of nitroglycerin is half a tablet. To determine individual tolerance, it is better to take the first dose in the presence of your doctor and when you are not experiencing an angina attack.

Nitroglycerin should be taken at 5-minute intervals until complete pain relief, but no longer than for 15 minutes (3 doses). If the pain is completely relieved within this time, you can take another tablet 15 minutes after the attack stops and the pain goes away. If you had to use 3 or more nitroglycerin tablets or if the intensity or duration of the attack differed from the previous attacks, you should contact your doctor. If pain behind the breastbone lasts for more than 15 minutes despite treatment, call the ambulance immediately.

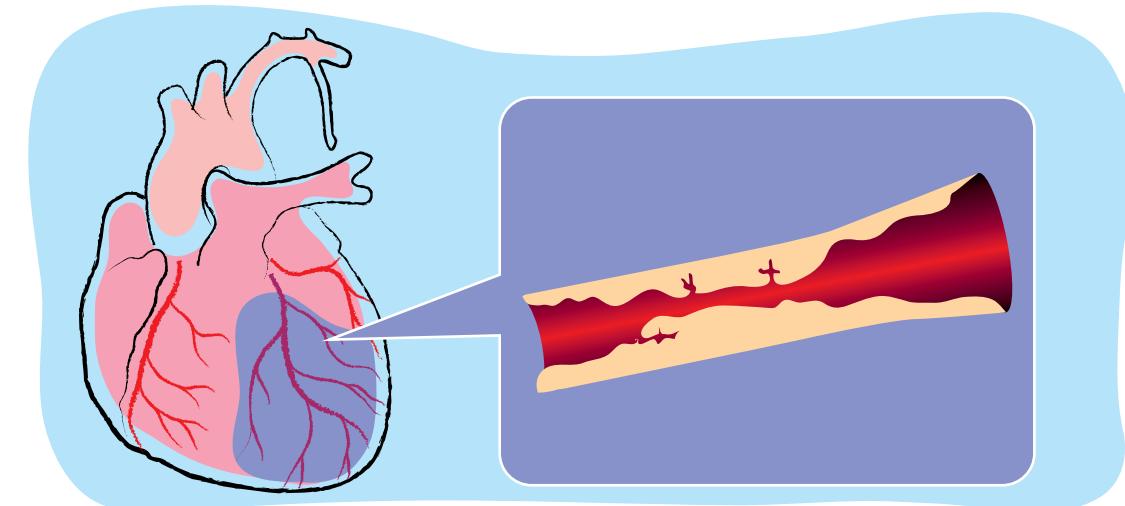
Unfortunately, nitroglycerin has some unpleasant side effects, such as headache, tinnitus and dizziness. For this reason, some patients avoid taking nitroglycerin. This is incorrect and dangerous. You should use the minimum effective dose and always follow the treatment regimen. This will reduce your need for nitroglycerin.

If you experience an angina attack that:

- develops during usual physical exercise or at rest;
- is not relieved by medication and rest;
- lasts longer than 15 minutes;

you must call an ambulance because you might be having unstable angina or myocardial infarction.

As mentioned before, myocardial infarction is caused by a complete blockage of a coronary artery, which leads to death of a part of your heart and may bring about serious complications, including death. The blockage may result from the continuous growth of plaque or, more likely, its break-off which leads to the formation of a thrombus or clot that blocks the vessel lumen. The pain in unstable angina or myocardial infarction is more intense, lasts longer than usual and is not relieved by regular angina medication. Moreover, you may experience nausea, shortness of breath, sweating and even vomiting. If this happens, it is important to call an ambulance to reach the hospital as soon as possible. You must not drive, because, in severe cases, you may lose consciousness or concentration. Blockage of the heart vessel can be removed in the hospital, and your circulation will be restored.



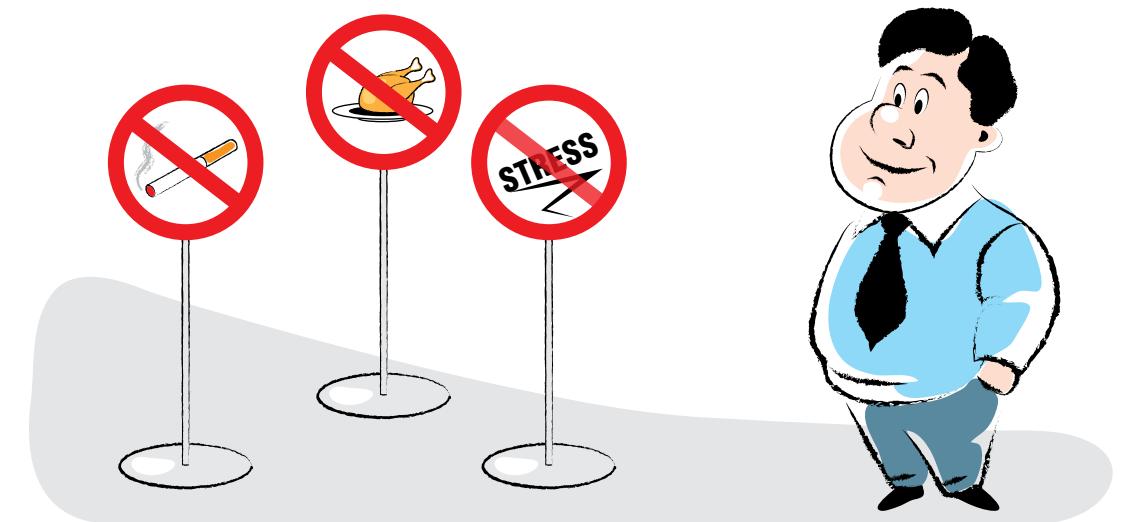
How to prevent angina?

As with other diseases, the treatment of angina should start with prevention, as well as management of all modifiable risk factors.

- **If you smoke, stop.** When you smoke, the risk of coronary heart disease (CHD) increases dramatically despite the type of cigarettes you smoke. It was calculated that the risk increases even if you smoke only one or two cigarettes a day. Smoking destroys your arteries; they age faster and become more susceptible to atherosclerosis. The incidence of myocardial infarction in young adults is higher among smokers. It is very hard to stop smoking, so you should consult your doctor.

- **Control your blood pressure and take steps to reduce it, if necessary.** If you have high blood pressure (hypertension), you should cut down on salt in your diet and take regular aerobic exercise for at least 30 minutes three times a week (running, swimming, cycling). There are different kinds of medicines to control blood pressure; however, you should consult your doctor to choose the best treatment option (often one medicine is not enough). Hypertension is a chronic disease that can be controlled by changing your lifestyle and taking medicines. If you achieve normal blood pressure after a treatment period, this is the result of the treatment regimen you are following. You must not stop the treatment without consulting your doctor.

- **Diabetes** is the most potent risk factor for CHD. If you have diabetes, you should thoroughly monitor and control your blood sugar level according to your doctor's recommendations. You must know how to measure your blood glucose level, follow the appropriate diet and take medicines which can be either hypoglycemic tablets or insulin, or a combination of both.
- You should also **check your blood cholesterol level regularly** and inform your doctor of the results. If you have high cholesterol level, you should change your diet; moreover, depending on your cholesterol level, the doctor may prescribe you lipid-lowering medicines, e.g., statins.
- **If you are overweight, lose weight.** Follow a diet that includes products low in fat and high in fiber, such as fruits and vegetables (at least five servings a week). Try to eat fish, such as sardines, herring or salmon, at least once a week (as a source of omega-3 fatty acids). Limit alcohol consumption. You should also exercise regularly. When you lose weight, your blood pressure will be easier to control, and your condition will improve.
- **Reduce stress to a minimum.** This factor is important, although people often overestimate it or consider heart disease a result of stress, underestimating the importance of other risk factors.



How is angina treated?

There are many known medicines which may prevent angina attacks and the development of such complication as myocardial infarction. Medical treatment of angina is based on two different groups of medicinal products:

1. Medicines reducing the risk of cardiovascular disease:

- **Aspirin.** Low-dose aspirin improves blood flow properties and decreases the risk of clotting. Unfortunately, aspirin has an adverse effect on gastrointestinal tract and may exacerbate ulcer disease in some patients. That is why, it is not the best option for everyone. However, treatment with aspirin is well tolerated by most patients.
- **Statins.** These medicinal products help reduce the cholesterol level preventing further fat deposition in coronary arteries. If, during treatment, you notice that your blood cholesterol level is even below normal, this is the treatment effect of statins. You should not stop this treatment regimen without consulting your doctor.
- **ACE inhibitors.** Treatment with these antihypertensive drugs allows to slow down the progress of atherosclerosis.

2. Medicinal products for symptomatic treatment:

These products help relieve any negative symptoms. In addition, some of them improve metabolism in the heart muscle.

- **Nitrates** (nitroglycerin) dilate the arteries improving the blood flow to the heart and other parts of the body. This makes it easier for your heart to pump blood without resistance of the narrowed vessels. Nitroglycerin is available in different dosage forms: sprays and tablets that go under your tongue. Some forms act very fast and are used for immediate relief during an attack, while others have a longer effect and prevent angina attacks. The drug enters your blood and relieves the symptoms of angina within several minutes. You should consult your doctor regarding the appropriate method of administration.
- **Beta-blockers.** These medicines protect the heart from excess loads, reducing its sensitivity to stress hormones, such as epinephrine and norepinephrine. Beta-blockers control the heart rate reducing the risk of oxygen starvation. They are contraindicated in patients with asthma.
- **Calcium channel blockers.** These medicinal products relax the coronary arteries and other blood vessels and reduce the force of the heartbeat. This type of medicines is often prescribed for patients intolerant to beta-blockers.
- **Sinus rhythm inhibitor.** This medicinal product relieves angina attacks by reducing the heart rate and restoring the balance between oxygen supply and demand without affecting other parameters, such as blood pressure.
- **Metabolic drugs.** These include drugs with various mechanisms of action, which preserve or alter cell energy metabolism increasing cell resistance to oxygen starvation, thus helping the heart to work more efficiently. If the symptoms cannot be relieved by medical treatment or you angina becomes unstable, you cardiologist will recommend you to have coronary angiography (X-ray scan of coronary arteries). This is an invasive test where a dye visible in X-rays is injected into your coronary arteries to see if they are narrowed or blocked. You doctor will choose the most appropriate revascularization method considering the number, severity and location of stenosis. Revascularization aims at restoring healthy (adequate) circulation in the heart area with narrowed arteries to relieve the symptoms of angina and prevent myocardial infarction.

There are two main revascularization techniques in angina:

1. **Angioplasty (percutaneous coronary intervention (PCI) or percutaneous transluminal coronary angioplasty (PTCA));**
2. **Coronary artery bypass graft (CABG).**

1. **Angioplasty (PCI or PTCA)** is an invasive (interventional) procedure to expand blood vessels. It is widely used in patients with minor blockages of one or two coronary arteries. During angioplasty, a vascular surgeon inserts

a catheter (a thin tube) into the radial artery of the arm or the femoral artery of the leg and threads it through your vessels until it reaches the heart.

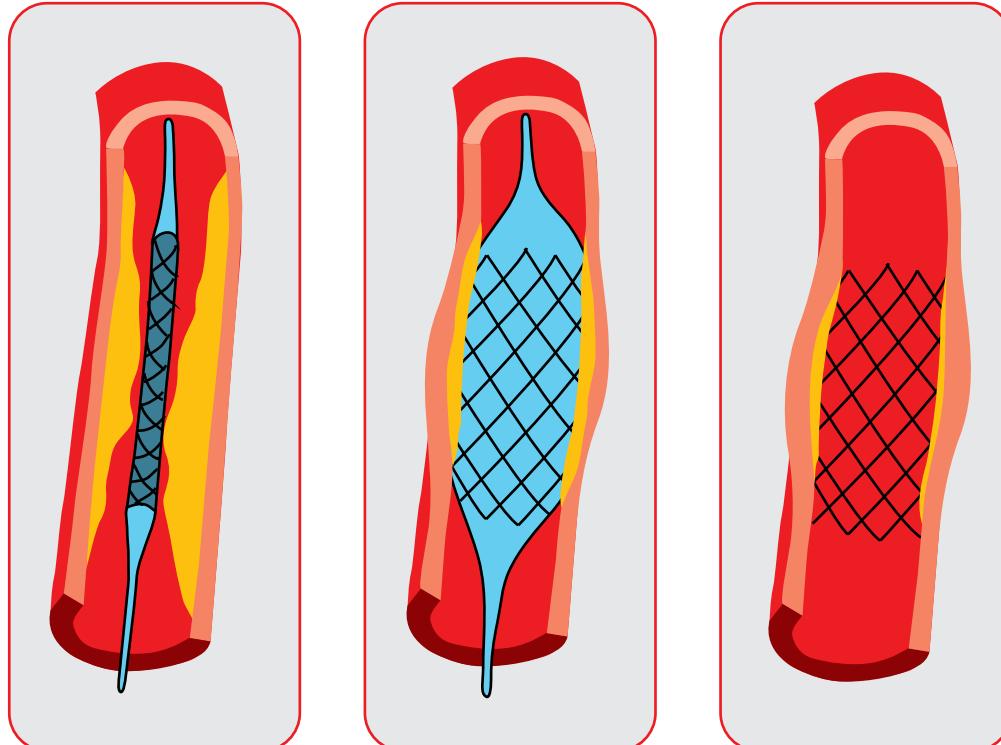
A special dye enters blood through a catheter visualizing the coronary arteries, and the entire process can be seen on the monitor screen. The doctor may wake you up during the procedure, and you may talk to him/her while he/she is working. As soon as the catheter reaches a blocked coronary artery, the vascular surgeon removes the blockage or flattens it inside the artery using different techniques. These techniques include:

- **Balloon angioplasty**, where a tiny balloon is attached to the catheter tip. When the catheter reaches the blockage site, the balloon is inflated, the plaque flattens against the artery walls, and the coronary artery opens. This procedure is followed by stenting.
- **Stenting** is a more recent technique used to keep the coronary arteries open. A small expandable tube made of metal mesh is placed around the catheter in the newly-opened area of the artery to keep it from narrowing again.

These two techniques are used together. After these procedures, you will be prescribed medicines to make you blood thinner and prevent clot formation at the site where the stent was placed. These medicinal products also increase the risk of bleeding; therefore, if you notice bruises on your skin after minor injuries, you should contact your doctor.

2. Coronary artery bypass graft surgery (CABG) is a procedure in which a part of blood vessel (usually from the patient's leg) is "grafted" to the heart to create a "bypass" around the narrowing of a coronary artery. Just like angioplasty, this procedure improves blood flow to the heart significantly reducing the risk of myocardial infarction. The CABG technique is normally used when all three main coronary arteries are blocked (the so-called triple vessel disease), when there is a significant blockage of the left main coronary artery, or when the blockage is diffuse and not amenable to angioplasty. Bypass surgery is a more aggressive technique compared to angioplasty: it is an open-heart surgery performed by a cardiac surgeon under general anesthesia (i.e., you will be unconscious).

Today, bypass surgery is a widely used technique; however, there are still some risks both directly associated with the surgical procedure and related to the patient's general health. You cardiologist can explain possible risks and benefits in each particular case.



*Insertion of a catheter
into a narrowed area*

*Balloon dilation
of an artery*

A stent in a vessel

Physical exercise and angina

Physical exercise is not only allowed but recommended for patients with coronary heart disease. However, not all types of exercise are appropriate: moderate-intensity aerobic exercise, such as fast walking, cycling or swimming, are good for you, but you should ask your doctor how much exercise you are allowed to take, and increase the load gradually. Isometric exercise, where muscles contract (are compressed) for a long time, is not suitable for people suffering from angina. Generally, isometric exercises include strength training and push-ups. Regular breathing exercise has been shown to have a positive effect on coronary arteries, slowing down the buildup of plaques either directly, due to the so-called massage effect on the endothelium (a layer of cells lining the inner surface of vessels), or indirectly, by reducing the body weight and blood pressure parameters, and improving blood glucose control in patients with diabetes mellitus.

You should know what level of physical activity triggers your angina attacks and try to stop and rest before you experience chest pain. For instance, if you feel chest pain after climbing two flights of stairs, you should stop and rest halfway before you continue climbing. In addition, you should check your blood pressure before starting to exercise: if your blood pressure is poorly controlled, you should avoid physical exertion, as it can be dangerous. You should also check your pulse while training, and your doctor will tell you when to stop (i.e., which heart rate is too high for you).

If you experience chest pain during physical exercise, stop and rest or take your medicine. The pain should go away within several minutes. If the pain is not relieved or lasts longer than usual, seek medical attention immediately.

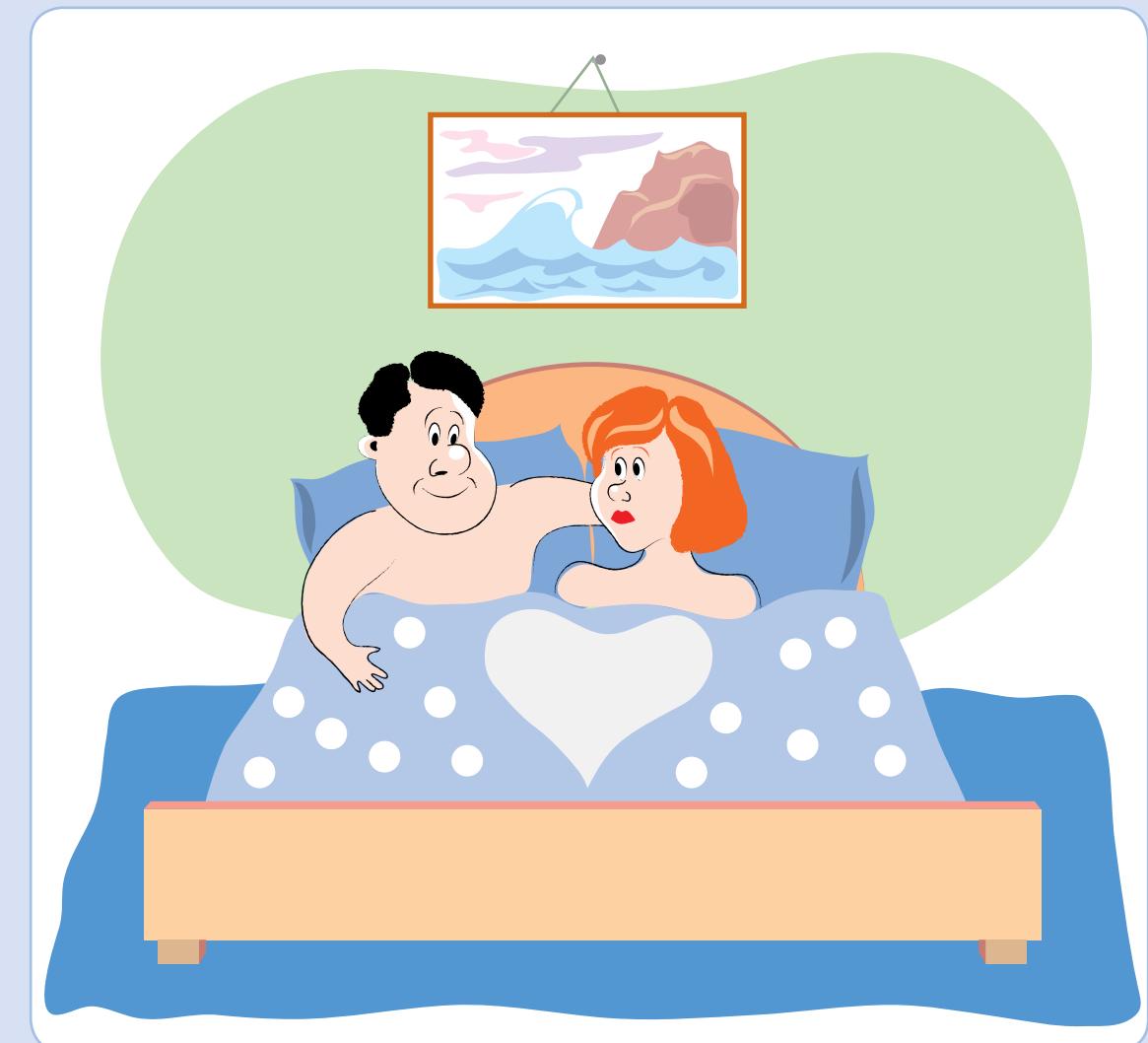


A few words about the important and intimate

Sexual relations must not be limited due to angina provided the patient has been informed about the relevant risk degree. Sexual intercourse does not increase your heart rate or blood pressure any more than other activities you can engage in during any 24-hour period.

Sometimes, a combination of physical activity and sexual arousal may trigger an angina attack. Yet, sexual activity should not be avoided only because it triggers angina attacks. Generally, attacks can be prevented by taking nitrates and beta-blockers in advance. You should ask your cardiologist for advice. The probability of erectile dysfunction grows with age; it has cardiovascular causes similar to those of stable angina. Medicines for treatment of erectile dysfunction can be used in patients with angina subject to some important precautions; that is why, you should discuss with your doctor any possible adverse interactions with other drugs.

Sexual activity is an important component of life, so you must discuss any problems with your doctor.



Notes